

COMPAX User Guide

Compact Servo Controller



From Software Version V3.74

May 99

HAUSER
We automate motion



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Data security

The parameter and program memory are created using ZP-RAM. This memory is unaffected by mains power failure.
 This module is guaranteed a service life of 10 years (calculated from the first start-up).
 ZP-RAM failure causes data loss; COMPAX contains wild data.
 If you encounter problems of this kind, contact HAUSER.

2. Unit assignment:

This documentation applies to the following units:

- ◆ COMPAX 25XXS
- ◆ COMPAX 45XXS
- ◆ COMPAX 85XXS
- ◆ COMPAX P1XXM
- ◆ COMPAX 02XXM
- ◆ COMPAX 05XXM
- ◆ COMPAX 15XXM
- ◆ COMPAX 35XXM

XX: Unit variants

Key to unit designation

e.g.: **COMPAX 0260M:**

COMPAX: name

02: performance class

60: variant e.g. "00": standard unit

"60": electronic transmission

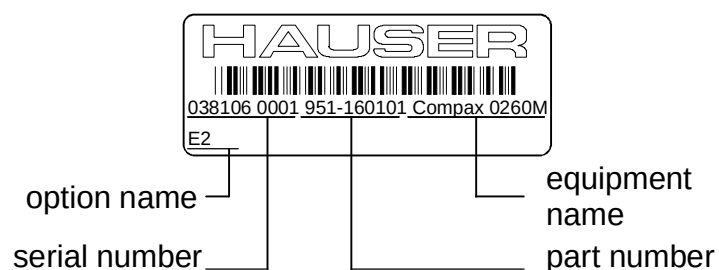
M: unit type "M": multiple-axis unit

"S": single-axis unit

...

HAUSER type plate

The type plate is found on the upper side of the unit and contains the following:



3. Safety instructions

3.1 General dangers

General dangers when safety instructions are not complied with

The unit described contains leading edge technology and is operationally reliable. However, danger is encountered if the unit is employed incorrectly or for improper use.

Energized, moving or rotating parts can

- ◆ cause fatal injury to the user
- ◆ cause material damage.

Proper use

This unit is designed for use in high voltage devices (VDE0160). This unit automates motion processes. The ability to switch several units at once makes it possible to combine several motion processes. Reciprocal interlocks must be installed in such instances.

3.2 Safety conscious working

The unit must only be operated by skilled staff.

- ◆ When used in this manual, the term "trained staff" refers to people who,
 - due to their training, experience and knowledge of current standards, guidelines, accident prevention regulations and operating conditions, have received authorization from the head of health and safety at the site to perform the necessary activities, while recognizing and avoiding any associated dangers (definition of personnel in accordance with VDE105 or IEC364)
 - are familiar with first aid and the on-site safety equipment,
 - have read and observe the safety instructions
 - have read and observe the User Guide (or the section which applies to the tasks to be performed).

This applies to all tasks relating to set-up, start-up, configuration, programming and modification of the operating conditions, operating modes and maintenance. Please note in particular the functions contained in the start-up manual relating to operational readiness and emergency stop.

The User Guide must be available at the unit whenever it is being operated.

3.3 Special safety instructions

- ◆ Check the arrangement of unit and documentation.
- ◆ Never disconnect the electrical connections when energized.
- ◆ Use safety devices to ensure that moving or rotating parts cannot be touched.
- ◆ Ensure that the unit is in perfect working order before operation.
- ◆ Implement operational readiness and emergency stop functions of unit (see start-up manual) in the safety and emergency stop functions of your machine.
- ◆ Only operate unit with the front cover attached.
- ◆ Ensure mains power module has sufficient nominal and peak performance ratings.
- ◆ Ensure that unit arrangement enables the units with higher performance ratings to be fitted more closely to the power unit than the units with lower ratings (COMPAX-M).
- ◆ Ensure that motors and linear drive units (if available) are secured sufficiently.
- ◆ Ensure that all energized connectors cannot be touched. The unit carries voltages ratings of up to 750V, which could fatally injure the operator.

3.4 Conditions of warranty

- ◆ The unit must not be opened.
- ◆ Do not make any alterations to the unit, except for those described in the User Guide.
- ◆ Only activate inputs, outputs and interfaces in the manner described in the User Guide.
- ◆ When installing units, ensure that the cooling bodies receive sufficient ventilation.
- ◆ Secure units in accordance with the assembly instructions contained in the start-up manual using the securing bores provided for this purpose. We cannot assume any responsibility for any other methods used for securing the units.

4. Switch on status

4.1 Configuration when supplied

COMPAX wird im unkonfigurierten Zustand ausgeliefert. Dabei steht der Parameter P149 auf "0":

P149="0": COMPAX ist nicht konfiguriert und geht nach dem Einschalten (24V DC und Leistungsspannung) in den OFF-Zustand (Motor stromlos). Außerdem werden beim Einschalten sämtliche Parameter (außer den Buseinstellungen P194, P195, P196 und P250) auf ihre Standardwerte gesetzt.

P149="1": COMPAX ist konfiguriert und versucht nach dem Einschalten (24V DC und Leistungsspannung) den Motor zuzuschalten.

4.2 Start-up

Meaning of LEDs on the front panel
COMPAX-M /-S

LED	Color	Meaning, when switched on
Ready	green	24V DC present and initialization complete
Error	red	COMPAX - fault (E1...E56) present. In COMPAX-S, also: mains supply or control voltage absent.

Mains power module

LED red Error	LED green Ready	Possible errors
off	on	no errors
on	off	Cooling body temperature too high or error in logistics voltage (24V DC too low or unit is defective)  Emergency stop is activated and ready contact is released.
on	on	Ballast switching device overload or undervoltage (<100V DC or <80V AC).



Caution

If the unit has no control voltage, no displays will appear indicating that operating voltage is available.

After 24V DC of control voltage is switched on, COMPAX has two status's available once the initialization phase has been completed:

1. COMPAX is OFF

COMPAX is not configured (P149="0") or
with COMPAX XX70:

E12="0" (final stage blocked).

Now configure ¹ COMPAX (e.g. using the ServoManager / ParameterEditor).

Set P149="1"

Configuration is accepted with VC and VP of COMPAX.

2. COMPAX displays error E57

COMPAX is configured (P149="1"). However, the operating voltage is not supplied.

Check COMPAX configuration 1.

Alterations are transferred with VC and VP of COMPAX.

1) **Configuring**

a) Using ServoManager:

P149="1", VP and VC are transferred when being downloaded to COMPAX from the ServoManager.

b) Using hand-held terminal:

P149="1", VP and VC are generated by the hand-held terminal.

a) Without an auxiliary device e.g. a terminal:

P149="1", VP and VC must be transmitted after COMPAX configuration.

Switch on operating voltage

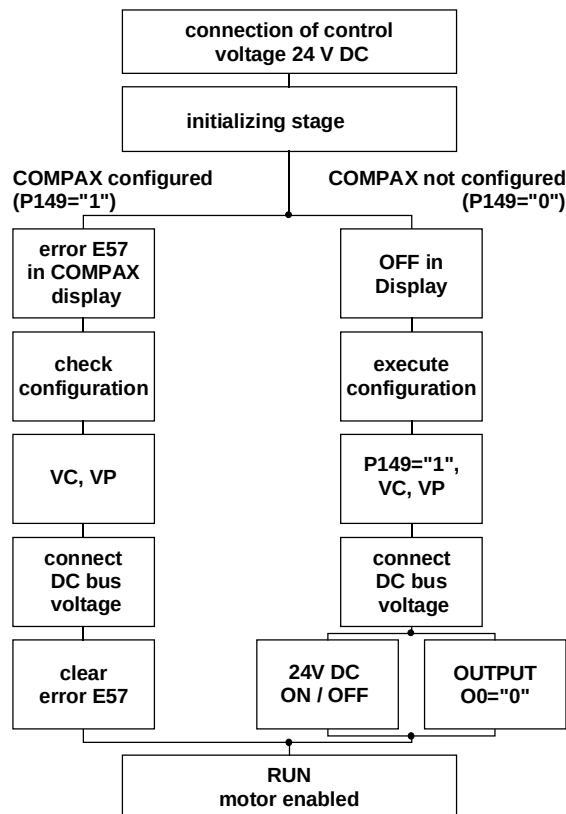
With E57: acknowledge error by pressing Enter.

When OFF: command: "OUTPUT O0=0" or

switch 24V DC on / off

Motor is powered. COMPAX display shows "RUN".

Flowchart:



4.3 Installing new equipment (replacement)

Previous software $\geq V2.0$

- ◆ Procedure for copying the complete COMPAX setting onto a new unit
- ◆ Start up ServoManager.
- ◆ Connect old COMPAX via RS232.
- ◆ Use menu "Insert: Axis: From controller" to set up an axis which contains all COMPAX settings (all parameters: including system parameters, data records and (with COMPAX XX70) existing curves).
- ◆ Connect new COMPAX.
- ◆ Use menu "Online: Download" to transfer data (without system parameters) into the new COMPAX.

Transferring system parameters

- ◆ Call up ParameterEditor (Menu: PC-Tools: ParameterEditor)
- ◆ Use "Online: copy" menu to transfer all parameters (including system parameters) to COMPAX.

Previous software $\leq V2.0$

Procedure for copying complete COMPAX setting to a new unit.

- ◆ Start ServoManager.
- ◆ Connect old COMPAX via RS232.
- ◆ Use menu "Insert: Axis: New" to set up a new axis.
- ◆ Use menu "Online: Upload" to load all COMPAX settings (all parameters: including system parameters, data records, and (in COMPAX XX70) also the existing curves) into the new axis.
- ◆ Connect new COMPAX.
- ◆ Use menu "Online: Download" to transfer the data (without system parameters) into the new COMPAX.

Transferring system parameters

- ◆ Call up ParameterEditor (Menu: PC-Tools: ParameterEditor)
- ◆ Use "Online: Copy" menu to transfer all parameters (including system parameters) to COMPAX.

5. Conditions for usage

for CE-compliant operation in industrial and business sectors

The EU guidelines on electromagnetic compatibility 89/336/EEC and electrical means of production for use within particular voltage limits 73/23/EEC are satisfied, if compliance is maintained with the following peripheral conditions.

Only operate the units in the condition in which they are supplied, i.e. with all housing plates and the front cover.

COMPAX P1XXM (without N1), COMPAX 02XXM, COMPAX 05XXM, and COMPAX 15XXM may only be operated with HAUSER mains power modules (NMD10 or NMD20) or on COMPAX 35XXM.

Grid filter:

A grid filter is required in the power line. The filtering can be performed once for the entire system or as separate process for each unit.

The following grid filters are required for standalone operation:

NMD10 / COMPAX 45XXS / COMPAX 85XXS: order no.: 073-605206

NMD20: order no.: 073-605207

COMPAX 35XXM: order no.: 073-605220

N1-Option / COMPAX 25XXS: order no.: 073-605201

Length of connection: connection between grid filter and unit:

unsheathed: < 0.5m

sheathed: < 5m

Motor and resolver cable:

Only operate the unit with a HAUSER motor and resolver cable (whose connector contains a special flat sheathing).

In such instances, the following cable lengths are permitted.

Motor cable	< 100m (the cable must not be rolled up) For motor lines of >20m, a motor output throttle must be used Up to 16A nominal motor current: type: 048-300010 16A / 2 mH. Between 16A and 30A: type: 048-300020 30A / 1.1 mH. Over 30A nominal motor current: type: 048-300030 >30A / 0.64 mH.
Resolver cable	< 100m

Motors:

Operate unit with HAUSER motors.

Control:

Only operate with calibrated closed-loop controller (avoid feedback oscillation).

Earthing:

- ◆ Connect the filter housing, the mains power module and the COMPAX flat, highly conductive, low inductivity with cabinet mass.
- ◆ Never secure the filter housing or the unit to coated surfaces.

Cable laying:

- ◆ Ensure that you have largest spacing possible between the signal and load lines.
- ◆ Signal lines must never pass sources of strong interference (motors, transformers, relays,...).

Accessories:

- ◆ Only use accessories recommended by HAUSER (absolute value sensor, encoder,...).



Ensure large contact areas down both sides of all cable sheathing.

6. Start-up manual

Compact servo control

6.1 Overview

6.1.1 Components required

In addition to a COMPAX itself, you will require the following components for a COMPAX application:

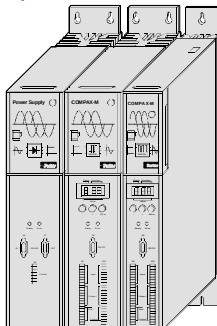
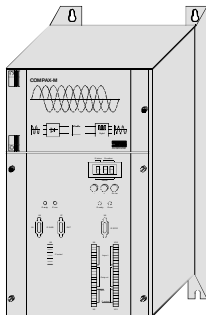
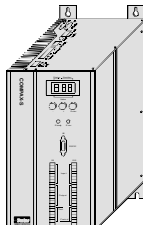
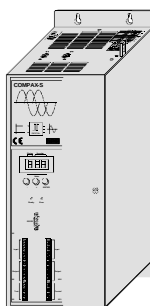
- ◆ a motor with or without a transmission.
- ◆ mains supply.
- ◆ 24V DC control voltage (not required for the COMPAX 45XXS and COMPAX 85XXS).
- ◆ actuation of emergency stop circuit.
- ◆ various cables for connecting the components.
 - ◆ motor cable and resolver cable.
 - ◆ supply line for voltage supply.
 - ◆ supply line for 24V DC control voltage.
- ◆ hand-held terminal or PC (with RS232 cable) containing the ServoManager program for configuring COMPAX.

6.1.2 Overview of unit technology

COMPAX-M and COMPAX-S

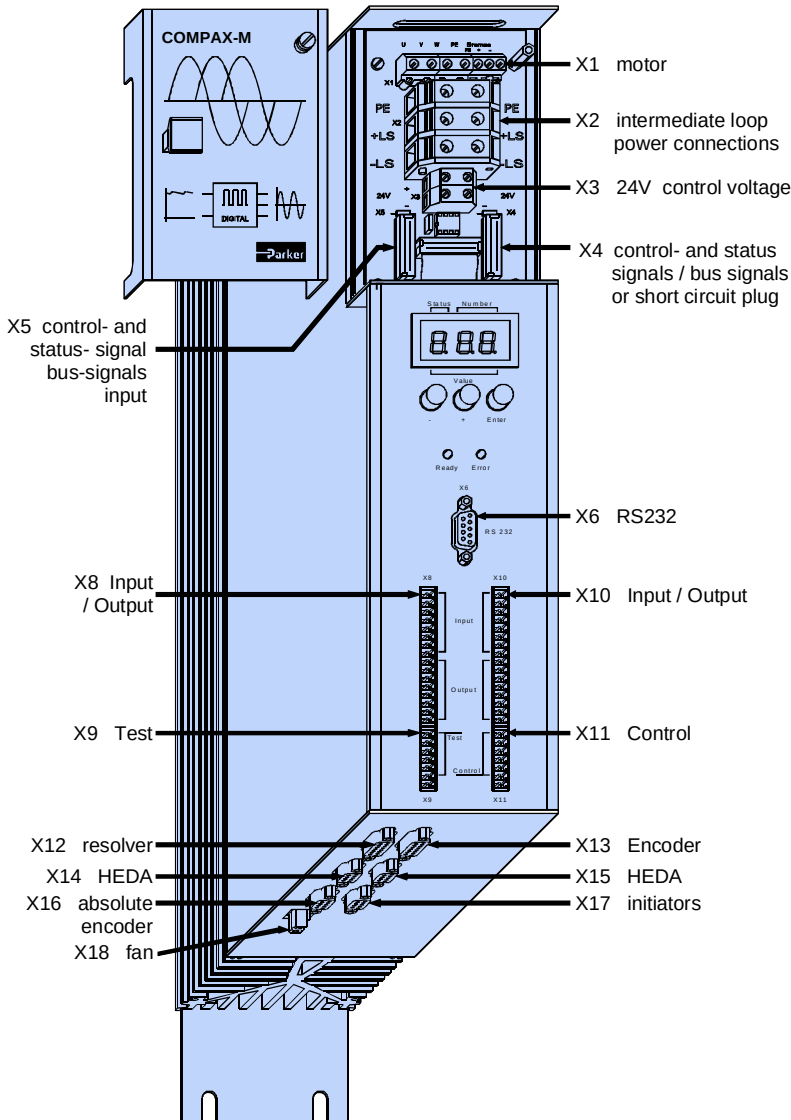
- ◆ are based on the same functional scope and the same controller hardware
- ◆ yet have differences with regard to
- ◆ housing and assembly technology and
- ◆ power areas.

The following table shows the main features of the range of units available.

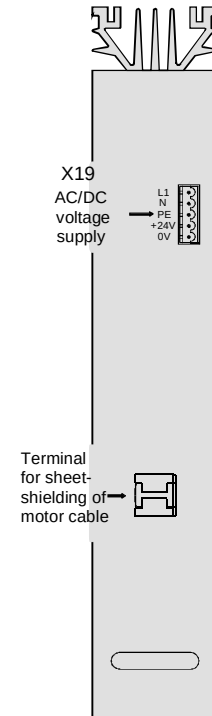
	COMPAX P1XXM COMPAX 02XXM COMPAX 05XXM COMPAX 15XXM	COMPAX 35XXM	COMPAX 25XXS	COMPAX 45XXS COMPAX 85XXS
Mains supply module / supply:	NMD10 / NMD20: Up to 500V AC	Integrated power unit Up to 3 * 500V AC	Integrated power unit Up to 250V AC or 3 * 230V AC	Integrated power unit Up to 3 * 500V AC
Dimensions:	COMPAX P1XXM: 340*400*60 [mm] COMPAX-M: 340*400*85 [mm]	340*400*220 [mm]	220*240*130 [mm]	275*350*125 [mm]
Design:	COMPAX-M with NMD mains power module 	COMPAX 35XXM 	COMPAX 25XXS 	COMPAX 45XXS / COMPAX 85XXS 
Installation:	can be arranged in rows COMPAX-M can be arranged in rows on COMPAX 35XXM		can be arranged in rows (however not in the COMPAX-M network)	
Connection with drive:	Resolver and motor cables are the same in all units Terminals for COMPAX-S connector terminals			
Interfaces:	The same for all units: digital inputs/outputs; RS232; test/control connector			
Options:	The same for all units: absolute value sensor; encoder input; encoder emulation; bus systems (not with N1 option); D/A monitor			

6.2 COMPAX-M unit features

6.2.1 Connector and connection assignment



COMPAX P1XXM plan view



Connector X19 is only available in the COMPAX P1XXM with N1 option (single-phase power supply).



Before wiring up, always de-energize the unit.

Even once the mains supply has been switched off, dangerous levels of voltage remain in the system for up to 5 min.

Meaning of the LEDs on the front plate

LED	Color	Meaning, is switched on
Ready	green	24V DC available and initialization complete.
Error	red	COMPAX error (E1...E56) is present.

6.2.2 COMPAX-M system network, NMD10 / NMD20 mains power module

A COMPAX-M drive system consists of one mains power module and one or more drive controllers. The units are coupled with one another by means of a flatband cable (see below). These are arranged behind the front plate cover of the power unit and the drive controller.

The power unit converts mains power (up to 3*500V AC) into DC current for the intermediate circuit.

The two connectors for connection to the bus systems are located on the front plate of the power unit. The connection arrangement is oriented to the specifications of 2-conductor remote bus.

The 24V DC of control voltage which is required in the system network is powered off the power unit.

A connector terminal on the front of the power unit is used for connecting the control and status signals (EMERGENCY STOP, readiness) which you can incorporate in the control of the entire system.

These signals, and bus lines, are connected internally via a flatband cable which is sheathed on both sides. These cables are available within the scope of supply of the drive controller supplier. The connectors which receive these connection cables are housed under the front plate cover of the mains power module and the drive controller.

Short circuit connectors

Attach a short circuit connector to the outgoing connector on the drive controller, i.e. the one which is furthest away from the mains power module. The short circuit connectors forms part of the scope of supply of the mains power module supplier.

Installation arrangement



Before wiring up, always de-energize the unit

Even once the mains supply has been switched off, dangerous levels of voltage remain in the system for up to 5 min.

Wiring up the system network

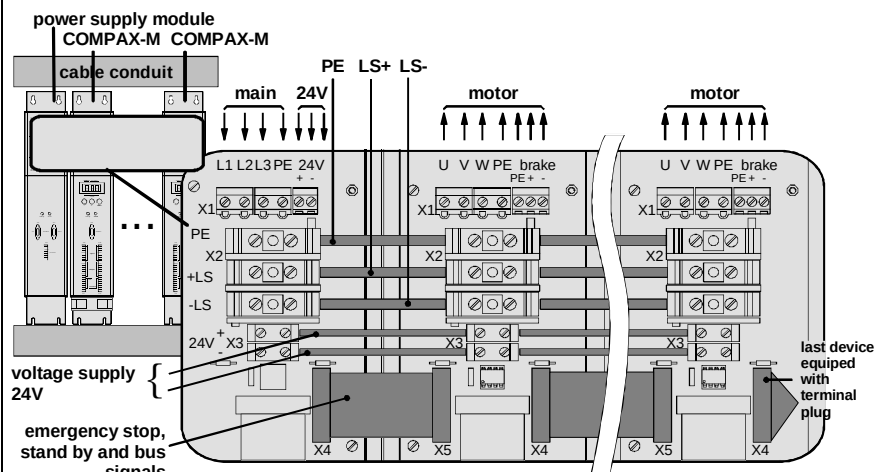
The wires required for creating the system network fall within the scope of supply. Open the front cover (upper section of front side) by loosening the top right knurled screw and wire up as follows:

- ◆ 24V DC voltage supply.
- ◆ PE and DC current.
- ◆ Emergency stop, ready and bus signals with a terminating connector on the last unit.

From the mains power module to the individual COMPAX-M.



When the unit is still in the original condition in which it is supplied, the terminating connector is located on the mains power module.



Wiring up the motor

Unit side

Note the sheath connection of the motor cable to the upper unit side. Clamp the motor cable with the open point of the sheet mesh under the ground terminal.

Shielding of motor cable



Only wire up brake in motors which have a holding brake. If the motor does not have a holding brake, do not wire up the brake.

Wiring up mains power / control voltage

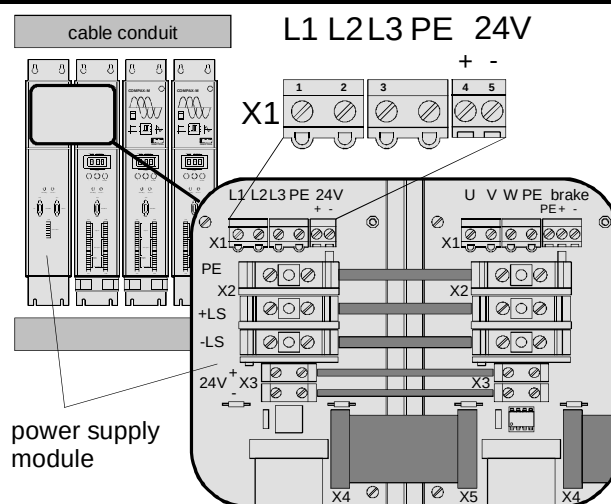
The mains supply line and the control voltage line can be found on the mains power module.

Mains power:

- ◆ 3*80V AC - 3*500V AC; 45 - 65 Hz
- ◆ NMD10: 16A (K circuit breaker in 20A)
- ◆ NMD20: 35A
- ◆ K circuit breaker or suitable Neozed conventional fuse.

Control voltage:

- ◆ 24V DC $\pm 10\%$
- ◆ Ripple $< 1V_{ss}$
- ◆ Fuse protection: 16A



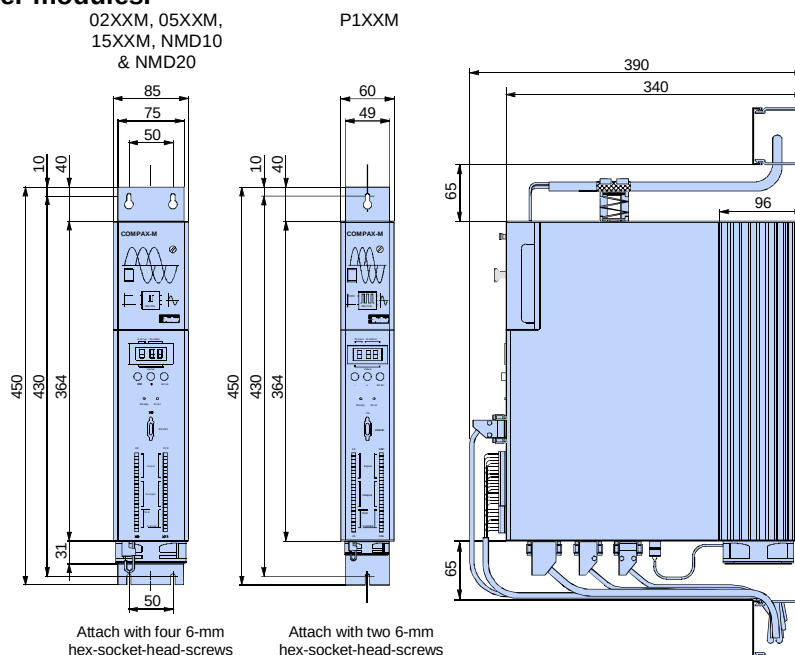
6.2.3 COMPAX-M dimensions/installation

The specific design of the COMPAX-M controller allows for wall installation (distance of 61mm in COMPAX P1XXM and 86 mm in larger units) in two different ways:

Direct wall installation:

The controllers are fastened to the installation plate using the back of the cooling body.

Direct wall installation and dimensions of COMPAX-M and the mains power modules.

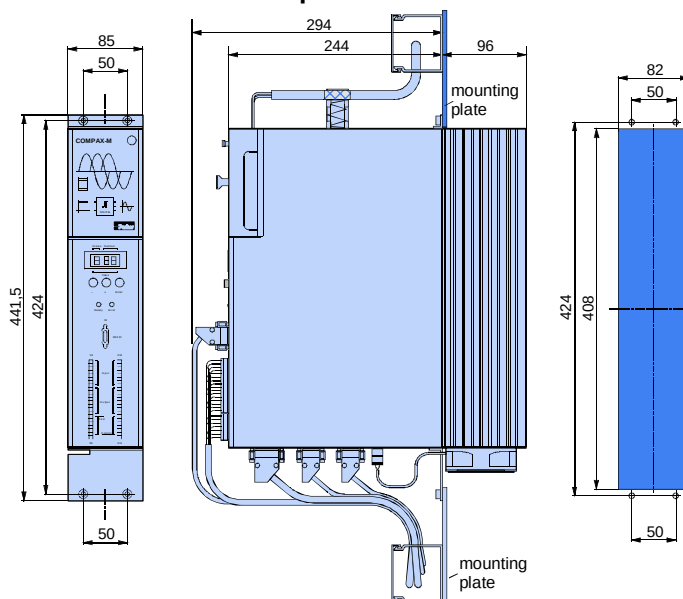


Indirect wall installation:

The cooling body is pushed through a hole in the installation plate (on right of figure) to the rear. A separate heat chamber is created between the installation plate and the rear wall of the control cabinet. You should comply with the angles required under designation MTS2.

➡ Indirect wall installation is not possible with the COMPAX P1XXM.

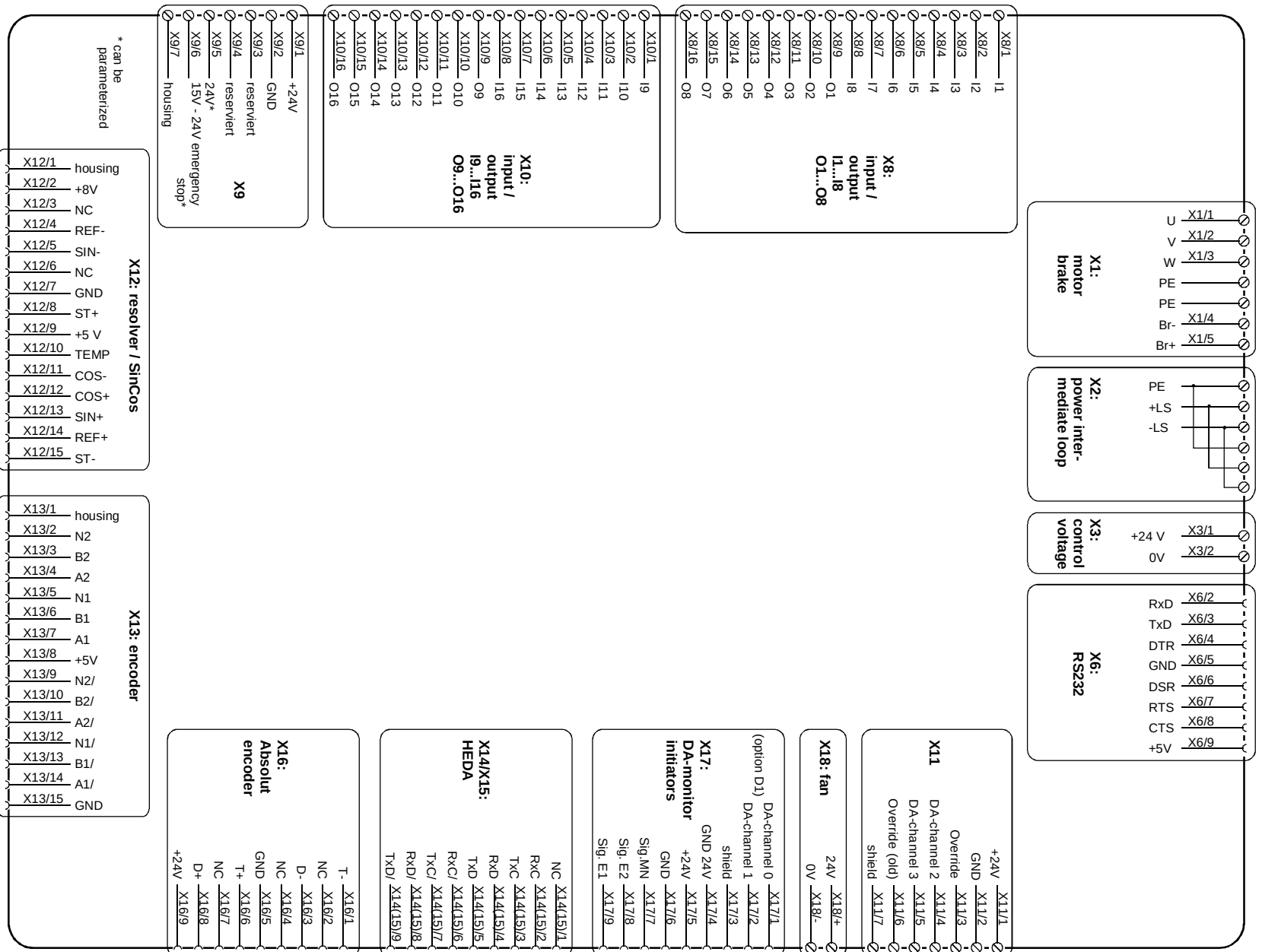
Indirect wall installation of COMPAX 02XXM, COMPAX 05XXM and COMPAX 15XXM and the mains power modules NMD10 and NMD20.



Fan configuration

Units with fan:	COMPAX P1XXM	COMPAX 05XXM	COMPAX 15XXM
Units without fan:	COMPAX 02XXM	NMD10	NMD20

6.2.4 Connector assignment COMPAX-M (without N1)

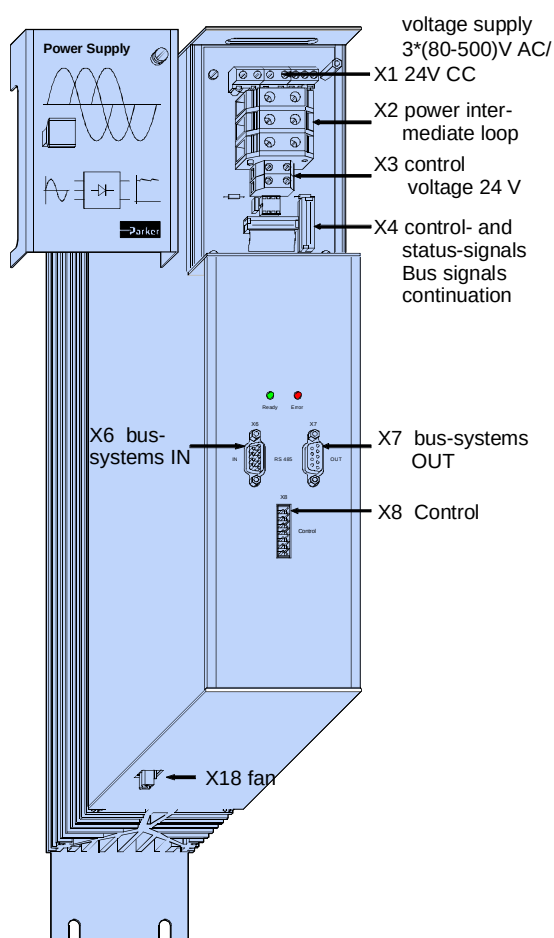


The bus connections are made via the mains power module.

6.3 Mains power module NMD10/NMD20

The mains power module ensures the supply of current to the COMPAX-M (not COMPAX 35XXM) axis controller and the SV drive connected into the network. It is connected to the 3-phase power supply with 3*400V AC and PE. 24V DC voltage should made be available for the control electronics.

6.3.1 Overview diagram



Before wiring-up, always de-energize the unit.

Even once the mains supply has been switched off, dangerous levels of voltage remain in the system for up to 5 min.

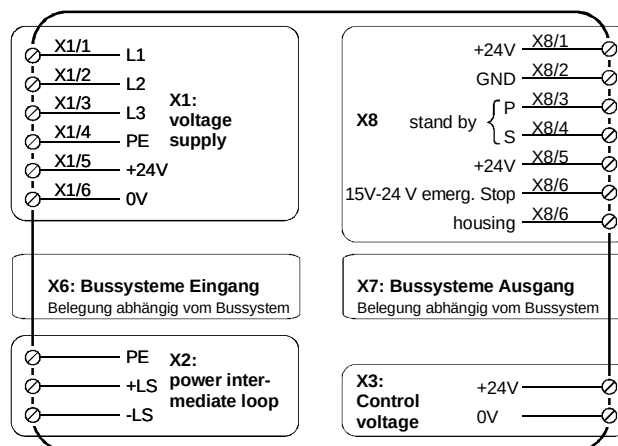


The PE connection should be a 10mm² version

6.3.2 Dimensions / installation

Dimensions and installation of the NMD10 and NMD20 power units correspond to the data for COMPAX-M (refer to page 20).

6.3.3 NMD connector assignment



6.3.4 Technical data / power features

Function

Generates DC current when run directly off a mains source.

CE conformity

- ◆ EMC susceptibility / emissions in acc. with EN61800-3.
- ◆ Safety: VDE 0160 / EN 50178.

Output rating

	Nominal output	Peak output
NMD10:	10 kW	20 kW (<3s)
NMD20:	20 kW	40 kW (<3s)

Mains supply fuse protection

NMD10: 16A (K circuit breaker in 20A)

NMD20: 35A

K circuit breaker or suitable Neozed conventional fuse.

Mains power up to 3*500V AC

Operating range: 3*80V AC - 3*500V AC; 45 - 65 Hz.

Control voltage

- ◆ Between 21.6V and 26.4V DC
- ◆ Ripple: < 1V_{ss}

- ◆ Fuse protection: 16A

Power losses

- ◆ without fan: max. 120W (standard)
- ◆ with fan: max. 250W.

Overvoltage limitation

The energy returned to the system during braking is stored in the intermediate circuit. The capacity and amount of energy which can be stored is:

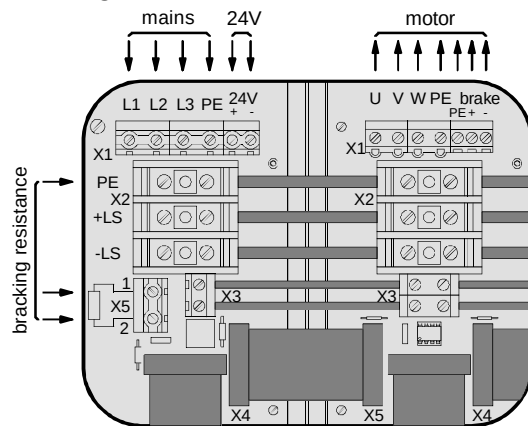
NMD10/NMD20: 1100mF / 173 Ws

If the energy recuperated from braking causes overvoltage, then ballast resistances are engaged.

Braking power	Lasts for	Cooling down time
NMD10		
17 kW	<50 ms	³ 10s
4.0 kW	<1s	³ 50s
Without fan: 120W	not limited	
With fan: 250W	not limited	
NMD20		
9.5 kW	<50 ms	³ 10s
2.5 kW	<1s	³ 50s
Without fan: 120W	not limited	
With fan: 200W	not limited	

➡ You can use external ballast resistances for NMD20 (refer to page 152).

Connecting the ballast resistance to NMD20



The ballast resistance is connected to X5/1, X5/2 and PE. The cable is fastened into the tension relief of the mains power cable. Output X5 is protected from short circuits.

Thermal monitoring protection

An emergency stop is triggered at 85°C cooling body temperature, the ready contact is released and the red LED lights up.

If a phase malfunctions, no displays appear

Error diagnosis in the mains power module

LED red Error	LED green Ready	Possible errors
off	on	No errors.
on	off	◆ Cooling body temperature too high - or ◆ error in logistics voltage (24V DC to low or unit defective) ➡ Emergency stop is triggered and the ready contact drops.
on	on	◆ Ballast switch overloaded - or ◆ undervoltage (<100V DC or <80V AC).

➡ Ready contact and green LED are coupled.



Caution

If the unit has no control voltage, no displays will not indicating that operating voltage is available.

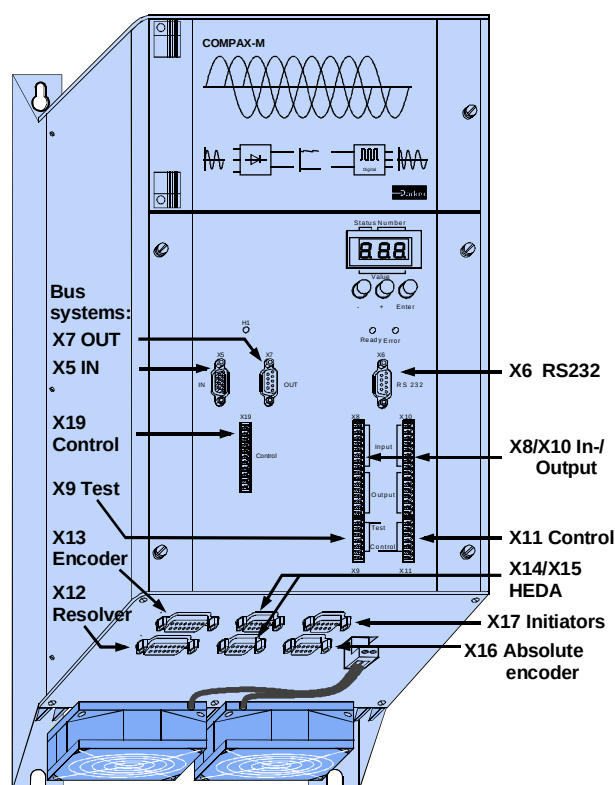
6.4 COMPAX 35XXM

6.4.1 Unit features

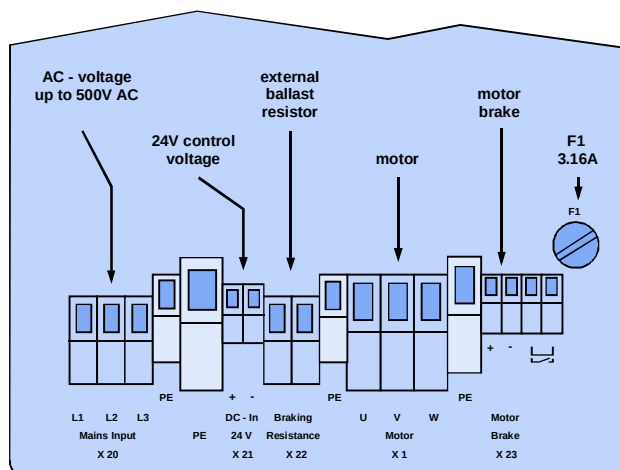
The 35 kW servo control COMPAX 35XXM - a performance upgrade to the COMPAX family.

- ◆ Compact unit with output currents of 50 A_{eff} / 100 A_{eff} (<5s) with integrated power unit.
- ◆ Additional COMPAX-M controllers of up to 15 kW can be arranged in rows.

6.4.2 Connector and connection assignment



Plan view



Specific technical data

Mains power

- ◆ 3*250V - 3*500V AC; 45-65 Hz.

Note!

Switching on the operating voltage for a second time:

Before switching on the operating voltage for a second time, you must wait for at least 2.5 minutes otherwise you may overload the condenser load resistance.

Mains supply fuse protection

62A K circuit breaker or suitable Neozed conventional fuse.

Braking mode

- ◆ Energy which can be stored
3450μF / 542 Ws
- ◆ External ballast resistance: 10Ω / 2 kW
For the external ballast resistances available, refer to page 152.



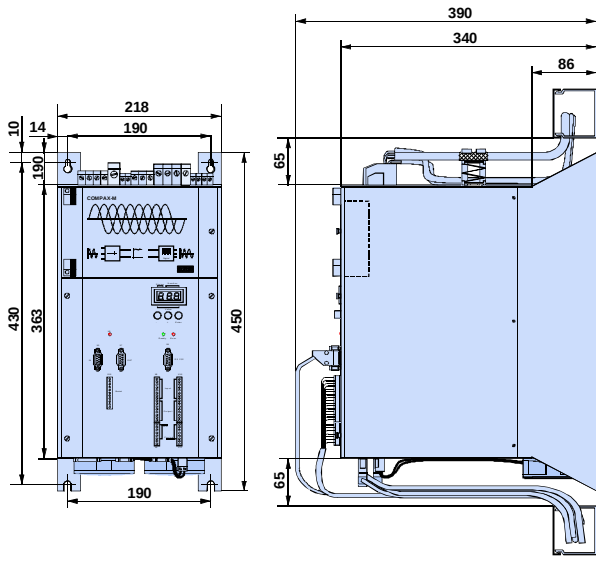
Before wiring up, always de-energize the unit.

Even once the mains supply has been switched off, dangerous levels of voltage remain in the system for up to 5 min.



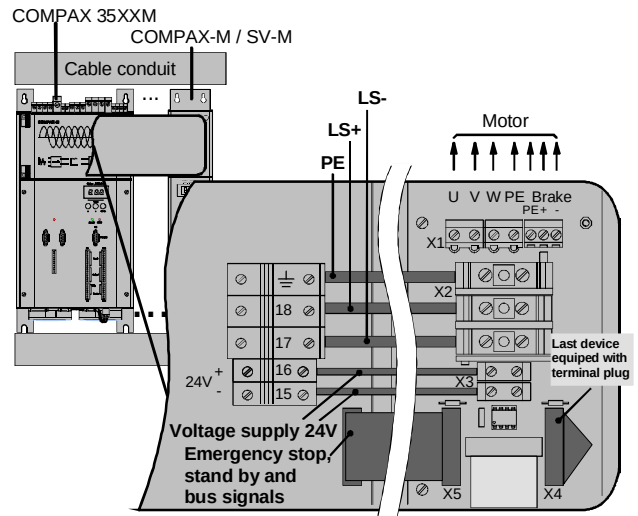
When working with motors without a holding brake, the brake lines must not be connected to COMPAX

6.4.3 Installation and dimensions



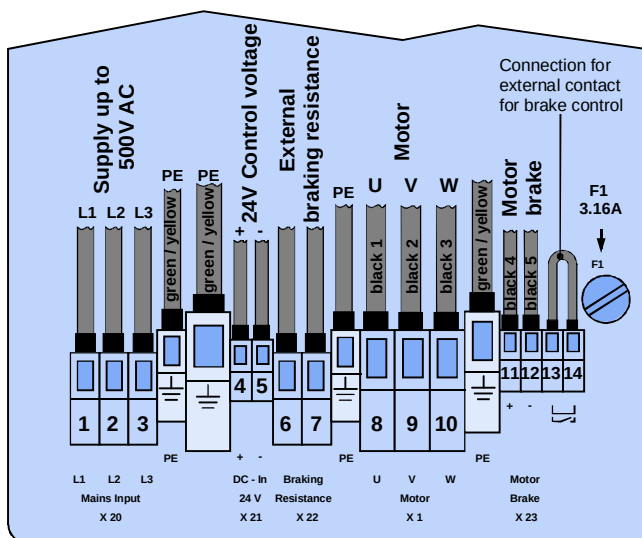
Fastening with 4 M6 Allen screws.

6.4.4.2 Wiring up system network



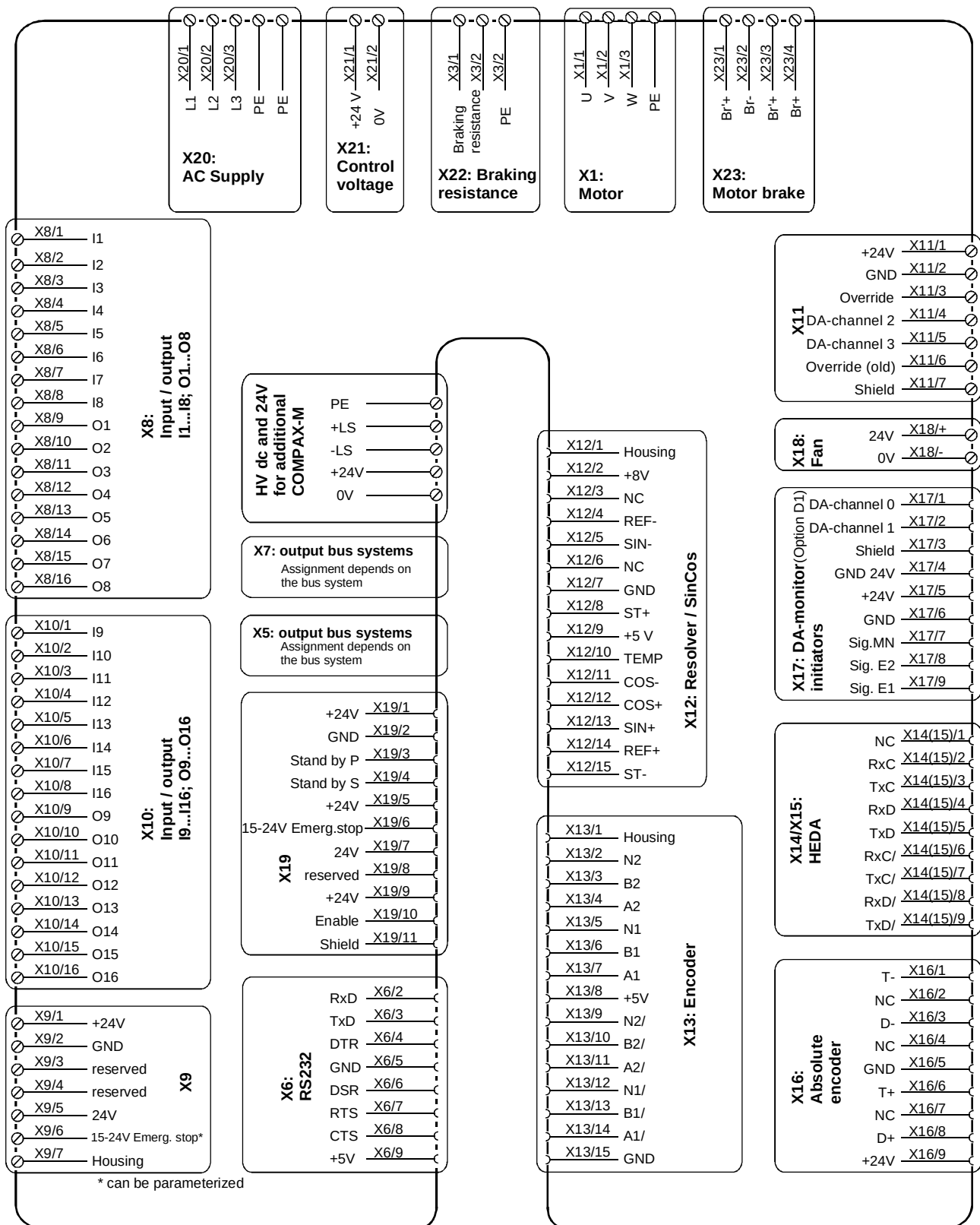
6.4.4 Wiring up

6.4.4.1 Wiring up motor, mains power / control voltage and external ballast resistance



The PE connection must be a version of at least 10mm²

6.4.5 COMPAX 35XXM connector assignment

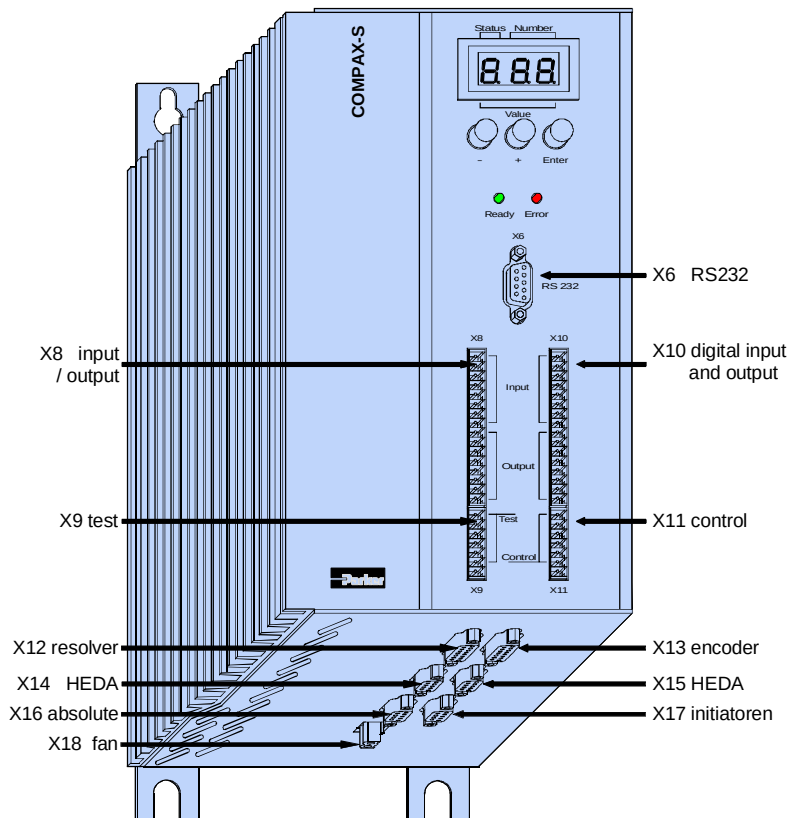


6.5 COMPAX 25XXS unit features

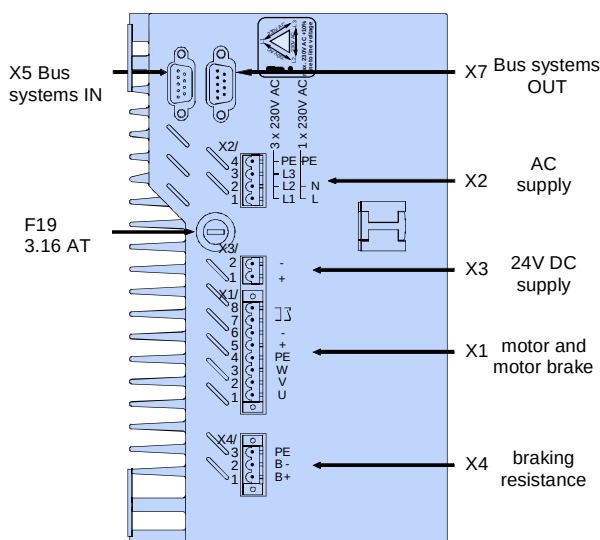
6.5.1 COMPAX 25XXS connector and connection assignment

Meaning of the LEDs on the front plate

LED / color	Meaning when switched on
Ready / green	24V DC available and initialization complete.
Error / red	COMPAX error (E1...E56) present.



Plan view of COMPAX 25XXS



Before wiring up, always de-energize the unit.
Even once the mains supply has been switched off, dangerous levels of voltage remain in the system for up to 5 min.



When working with motors without a holding brake, the brake lines must not be connected to COMPAX

Wiring up motor

On unit side

- ◆ Note the sheath connection of the motor cable on the upper side of the unit.
- ◆ Clamp the motor cable with the open point of the sheath mesh under the ground terminal.

Motor side

- ◆ Via connectors.

Wiring up mains power / control voltage

The mains supply line and control voltage line can be found on the upper side of the unit.

Mains power: you have 2 options (with the same output rating):

- 3*80V AC - 3*250V AC • 45-65 Hz • Fuse protection: 10A
- 1*100V AC - 1*250V AC • 45-65 Hz • Fuse protection: 16A

◆ Control voltage: 24V DC $\pm 10\%$ ripple $< 1V_{ss}$
Fuse protection: 16A

Note! Do not apply 3*400V AC.

Only wire up brake in motors which have a holding brake. If the motor does not have a holding brake, do not wire up the brake.

6.5.2 COMPAX 25XXS specific technical data

Overvoltage limitation

- ◆ The energy recuperated during braking is stored in the intermediate circuit. The capacity and energy which can be stored are:

COMPAX 25XXS: 1000 mF / 27 Ws

If the recuperated energy causes overvoltage, then external ballast resistances can be engaged.

Maximum braking power with external ballast resistance

Braking power	Lasts for	Cooling down time
COMPAX 25XXS: £1.0 kW	not limited	
When $R_{ext} \geq 56W$: £2.5 kW	<2s	$\geq 10s$

➡ We supply an external ballast resistance for COMPAX 25XXS (refer to page 152).

Connecting ballast resistance to COMPAX-S

The ballast resistance is connected to B+, B- and, if necessary, PE.

Output X4 is protected from short circuits.

Mating connectors X1, X2, X3 and X4

Mating connectors for X1,...X4 are available within the scope of supply of Phoenix and have the following type designations:

- X1: MSTB2,5/8/STF-5.08 (with screw connection)
- X2: MSTB2,5/4/ST-5.08 (without screw connection)
- X3: MSTB2,5/2/ST-5.08 (without screw connection)
- X4: MSTB2,5/3/STF-5.08 (with screw connection)

You can acquire Phoenix housings for these connectors and these can be used once adapted to our cables. Designation: KGG-MSTB2.5/(pin number).

6.5.3 COMPAX 25XXS dimensions / installation

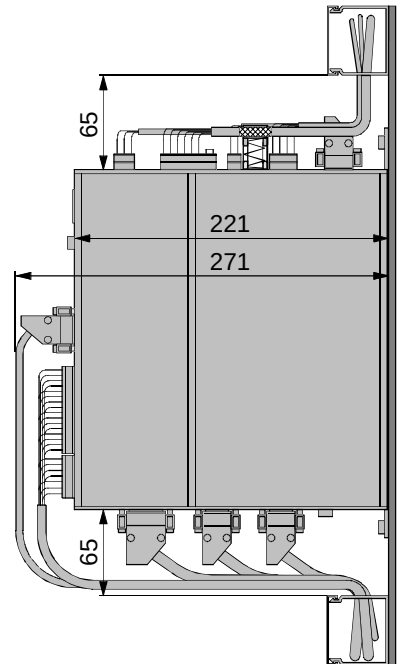
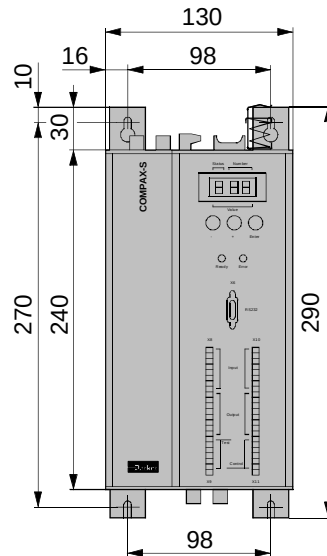
The two supplied retaining plates can optionally be screwed onto the 2 sides (cooling body side and rear, left-hand side). Retaining screws: 4 M6 Allen screws.

6.5.3.1 Design can be arranged in rows

The left-hand side of the cooling body is fastened to the unit. This is fastened to a metal wall using 2 retaining plate. Installation distance: 135 mm

Delivery status

This is the unit design we deliver.



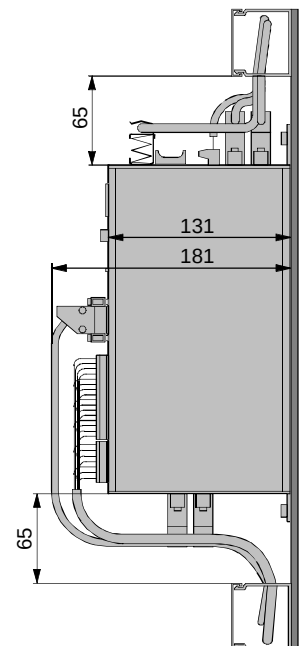
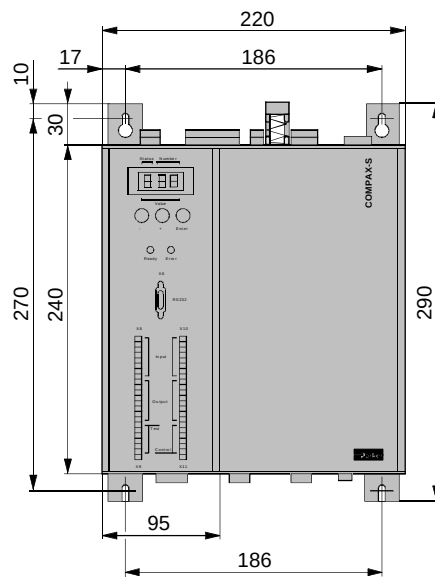
6.5.3.2 Flat design

The left-hand side of the cooling body is fastened to the unit. It is fastened to a metal wall using 2 retaining plates.

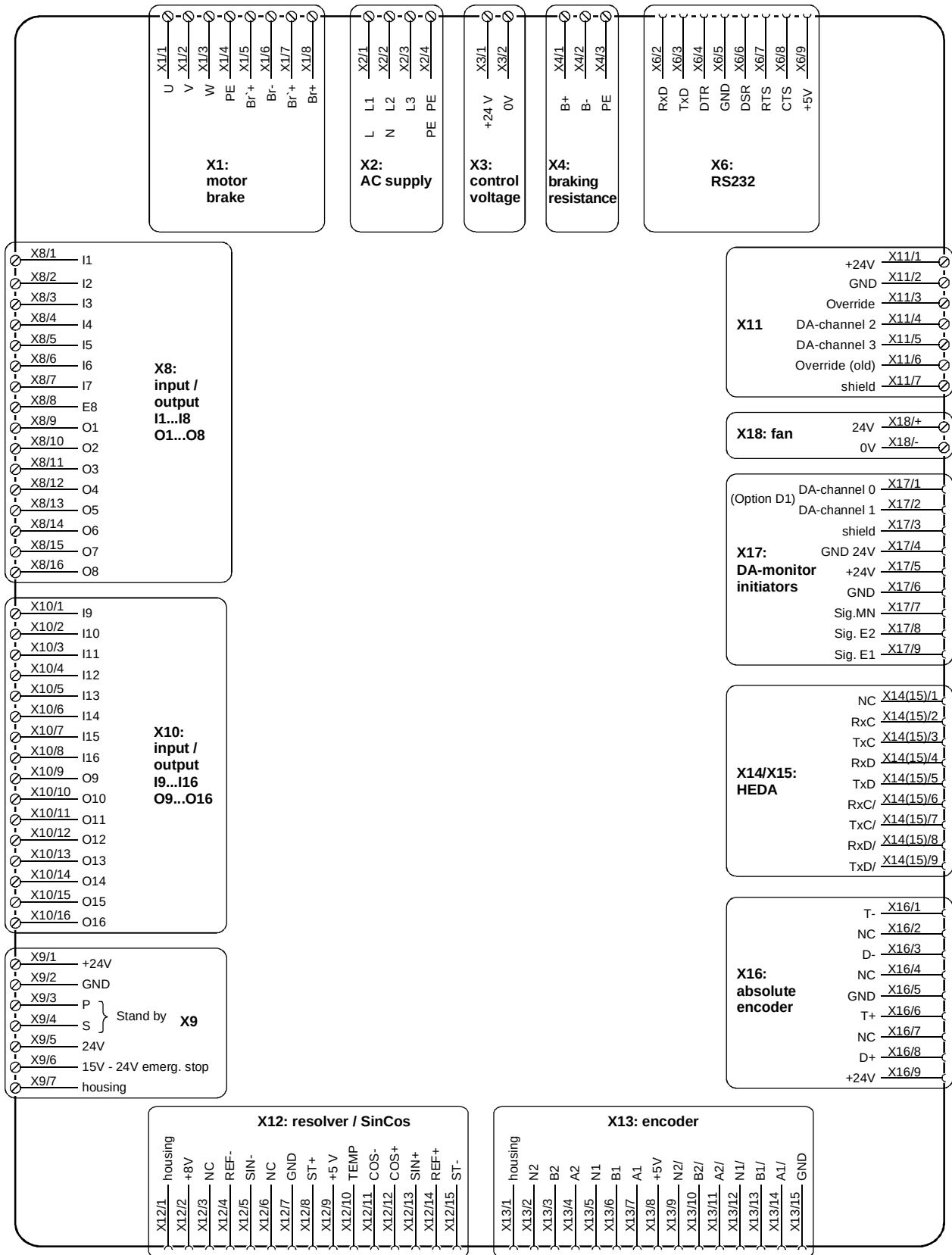
6.5.3.3 Converting the front plates

- ◆ Install the retaining plate on the desired side.
- ◆ Unfasten front plate and blind plate. There are 2 screws on both the upper and lower sides of the unit.

Firstly install the front plate and then the blind plate to the desired point.



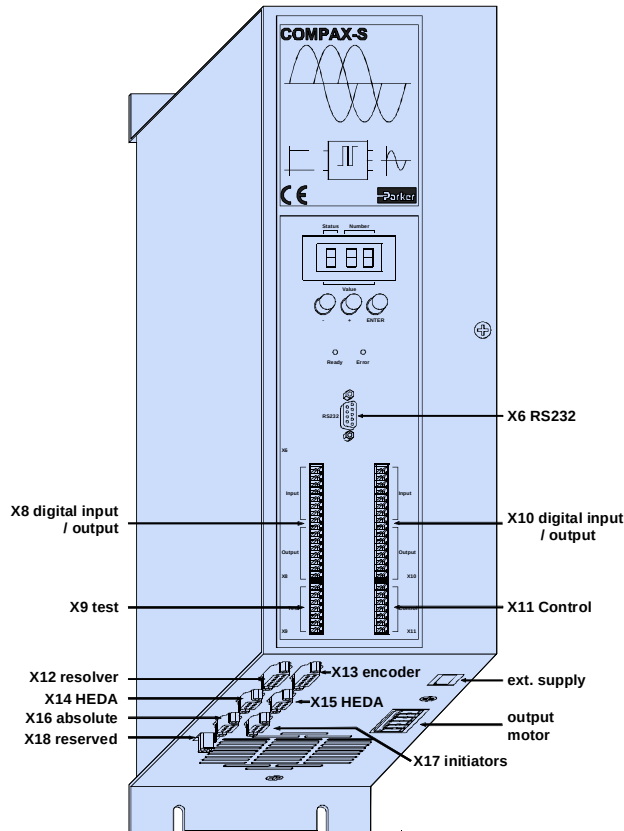
6.5.4 COMPAX 25XXS connector assignment



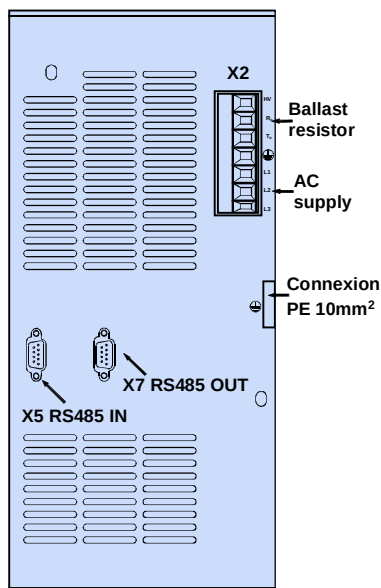
You will find the assignment of the connectors X5 and X7 (bus systems) on page 41!

6.6 COMPAX 45XXS/85XXS unit features

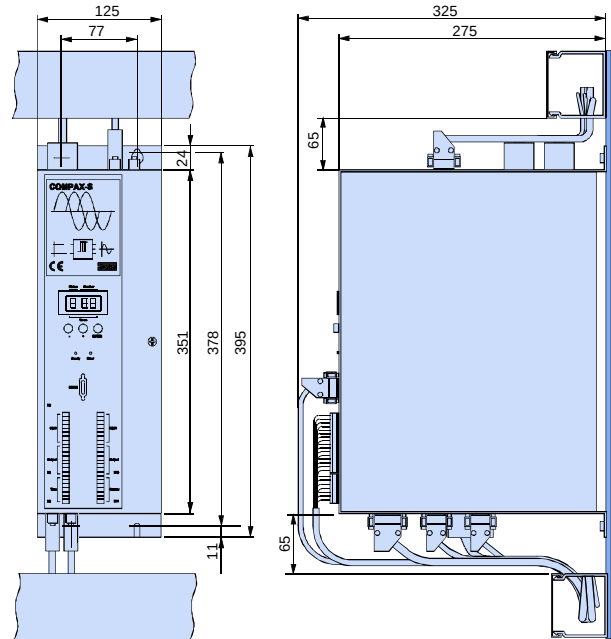
6.6.1 COMPAX 45XXS/85XXS connector and connection assignment



Plan view



6.6.2 COMPAX 45XXS/85XXS installation / dimensions



Fastening: 4 M5 Allen screws

Meaning of LEDs on the front plate

LED	Color	Meaning when switched on
Ready	green	24V DC available and initialization complete.
Error	red	COMPAX error present. or mains power or control voltage missing.



Before wiring up, always de-energize the unit.

Even once the mains supply has been switched off, dangerous levels of voltage remain in the system for up to 5 min.



When working with motors without a holding brake, the brake lines must not be connected to COMPAX

6.6.3 COMPAX 45XXS/85XXS specific wiring

Wiring up mains power / approval of the internal ballast resistance	Wiring up motor / control voltage / enable
HV: DC current output	
♦ Mains power: 3*340V AC - 3*500V AC; 45-65 Hz. with external 24V DC: 3*80V AC - 3*500V AC; fuse protection: 16A ♦ Control voltage: 24V DC $\pm 10\%$ ripple $< 1V_{ss}$ - Operation is also possible without control voltage being supplied externally: COMPAX 45XXS and COMPAX 85XXS then creates the control voltage internally from the mains power. Limitation: when the mains power is switched off, the saved present position is lost. ♦ Note the sheath connection of the motor cable on the lower side of the unit. ➡ Clamp the motor cable with the open point of the sheath mesh under the ground terminal.	
! Only wire up brake lines in motors which have a holding brake. If the motor does not have a holding brake, do not wire up brake.	

Enable bridges: X3/1 - X3/2

The final stage is released using a bridge between X3/1 - X3/2.

If this switch operation is not in place, the final stage is switched off and error message E40 appears (refer to page 179).

Overvoltage limitation

- ♦ The energy recuperated during braking is stored in the intermediate circuit. The capacity and the energy which can be stored are:

- COMPAX 45XXS: 330 μ F / 52 Ws
- COMPAX 85XXS: 500 μ F / 80 Ws

If the recuperated energy causes overvoltage, then the internal ballast resistance is engaged.

Enable internal ballast resistance: X2/5 - X2/6

The internal ballast resistance is released by a bridge between X2/5 and X2/6.

If this switch operation is not in place, the controller operates without ballast resistance; in braking mode, error message E38 may appear (refer to page 179).

Maximum braking power of the internal ballast resistance

Braking power	Lasts for	Cooling down time
COMPAX 45/85S: 300W	not limited	
≤ 1.5 kW	< 10 s	$^3 10$ s

➡ We supply an external ballast resistance for COMPAX 45XXS / 85XXS (refer to page 152).

Connecting a ballast resistance to COMPAX 4500S/ COMPAX 8500S

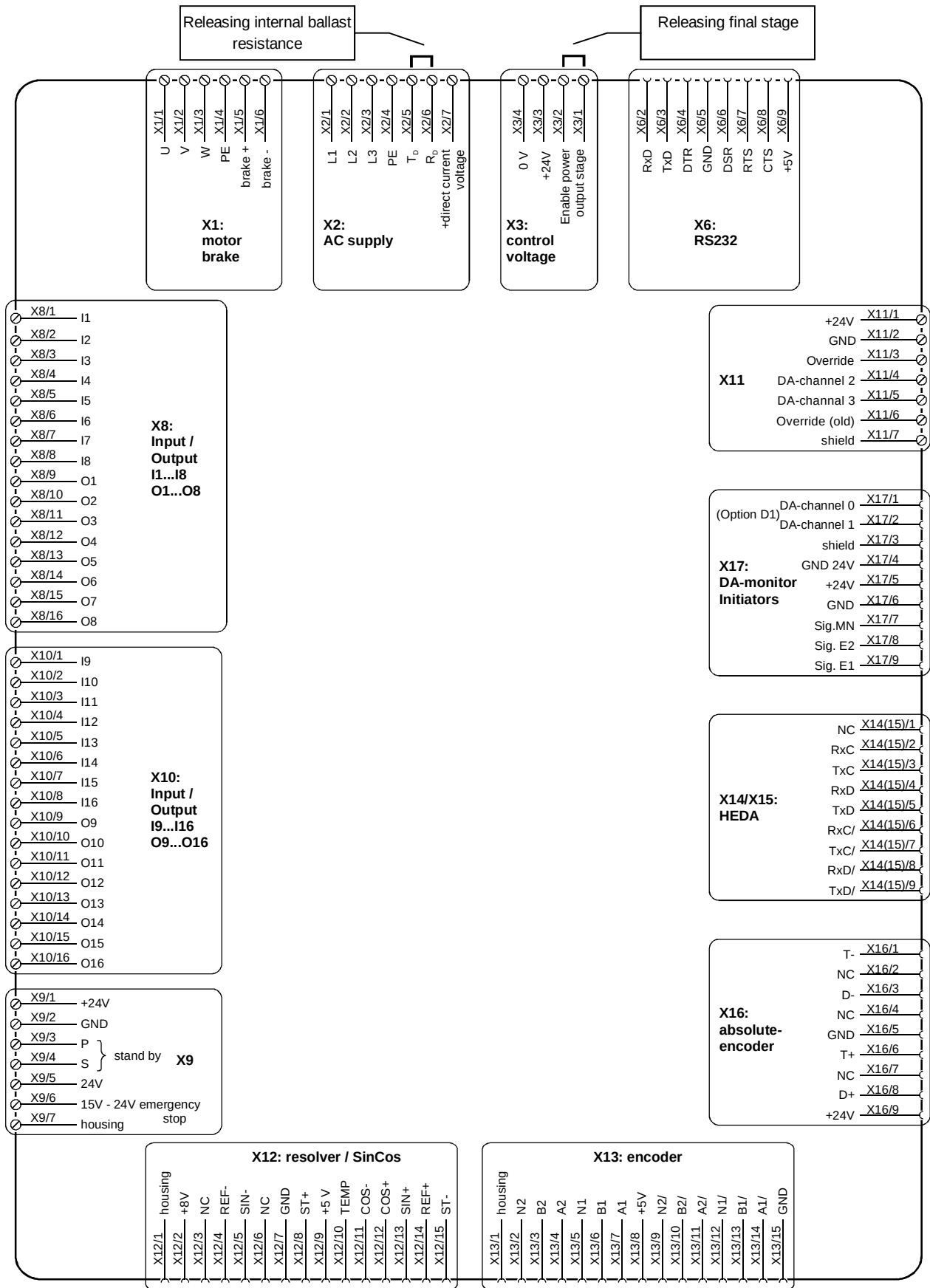
The ballast resistance is connected to HV, T_D and PE.

The output is protected from short circuits.

Note!

When an external ballast resistance is connected, the bridge between R_D and T_D must be removed.

6.6.4 COMPAX 45XXS/85XXS connector and pin assignment



You will find the assignment of the connectors X5 and X7 (bus systems) on page 41!

6.7 Safety chain / emergency stop functions

Readiness, safety chain

Establishing a safety chain for monitoring the drives and other control components and or a superordinate control unit usually requires a connection protected from wire breaks. The contact outputs (closer) P (X8(9)/3) and S (X8(9)/4) are used for this purpose. This closer establishes sequential switching for the mains power module and the axis controller. When the unit is operating correctly, the contacts are closed (P and S are connected) and thereby indicate the readiness of the unit. If an error occurs or if the drive system is switched off, the readiness is not displayed and the chain is interrupted (see below).

Emergency stop

The emergency stop input is used to activate or deactivate all drive controllers or an individual controller supplied by the mains power module. In accordance with the safety chain described above, this input must be activated to power the motors. This is either down via an external contact between X8(9)/5 and X8(9)/6 (as is shown in the figure below) or by attaching voltage of between 15V and 24V to the input X8(9)/6 against GND (X8(9)/2). If the contact is opened or the voltage is removed from X8(9)/6 or routed to GND/24V, the emergency stop sequence is processed, e.g. all motors of the connected drive controller are decelerated and switched off (no torque on the motor shaft); the ready contact drops.

Emergency stop characteristics :

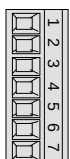
- ◆ After an emergency stop: error E55 (even in OFF status) and O1="0". The present command is interrupted.
- ◆ The controller brakes the motor (braking time: P10 relative to the time set by ACCEL).
- ◆ When at a standstill, the controller is switched off, if in place, the standstill retaining brakes is closed.
- ◆ Once the problem has been rectified, E55 must be acknowledged.
- ◆ The present command is continued after START.

Emergency stop and ready on connector:

NMD: X8

COMPAX-S: X9: and COMPAX 35XXM: X19

plug: Phoenix
MC1,5/7-ST-3,81

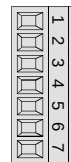


Pin	designation	function
1	+24V	voltage supply (output)
2	GND	
3	P	readiness contact
4	S	readiness contact
5	24V	emergency stop output
6	15V - 24V	emergency stop input
7	housing	shield connection

Emergency stop input direct on COMPAX-M X9 (COMPAX-M without N1)

Assignment of X9 (without N1 option)

Phoenix
MC1,5/7-ST-3,81



Pin	designation	function
1	+24V	voltage supply (output <50mA)
2	Masse	
3		reserved
4		reserved
5	24V	output*
6	15 - 24V	emergency stop*
7	shield	

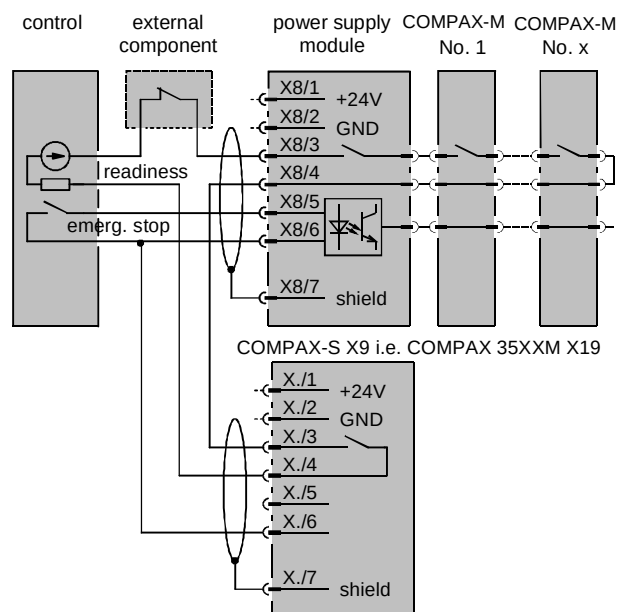
* Emergency stop input on COMPAX-M

The emergency stop input on COMPAX-M X9 (without N1) is engaged via parameter P219.

Meaning:

- ◆ P219="0": no emergency stop input on COMPAX-M X9
- ◆ P219="7": emergency stop input on COMPAX-M X9 with the following data
 - ◆ Stop using P10 as relative ramp time (P10 = braking time from 100% speed to 0%).
 - ◆ The motor is then switched off.
 - ◆ Error message E56 is then generated.
 - ◆ The ready contact drops.

Principle behind the safety chain and emergency stop function



➡ Applies to potential - 24V power supply.

Ready contact: max. 0.5A, 60V, 30W

6.8 Connections to the motor

You will find the wiring diagrams in the motor catalogue (no. 192-060011)

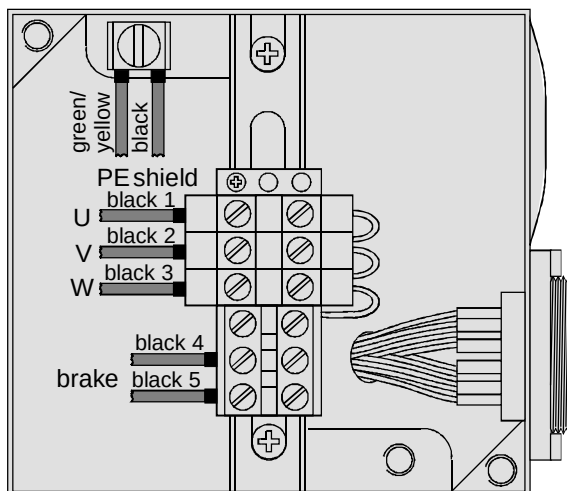
		Resolver cable	Sensor cable (SinCos)	Motor cable				
				With connectors: HJ96, HJ116, HDY55, HDY70, HDY92, HDY115		With terminal boxes: HJ155, HJ190 HDY142		
				1.5 mm ² up to 13.8A	2.5 mm ² up to 18.9A	2.5 mm ² up to 18.9A	6 mm ² up to 32.3A	10mm ² up to 47.3A
Standard	Cable sheathed	REK32/..	GBK16/..	MOK42/..	MOK43/..	MOK21/..	MOK11/..	MOK46/..
	Connector set	085-301312 800-030031	085-301317 800-030031	085-301306	085-301306	125-518162 125-216800	125-518211 125-217000	125-518200
	Cable	102-150200	102-150210	102-508896	102-508902	102-508902	102-150030	102-150040
High-flex	Cable sheathed	REK33/..	GBK17/..	MOK44/..	MOK45/..	MOK14/..	MOK11/..	MOK46/..
	Connector set	085-301312 800-030031	085-301317 800-030031	085-301306	085-301306	125-518162 125-216800	125-518211 125-217000	125-518200
	Cable	102-000030	-	102-000020	102-000010	102-000010	102-150030	102-150040

Length key of the sheathed cables

Length [m]	1.0	2.5	5.0	7.5	10.0	12.5	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
Key	01	02	03	04	05	06	07	08	09	10	11	12	13	14

Example REK32/09: length 25m

Cable assignment in the terminal boxes

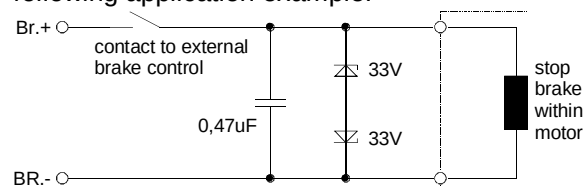


6.8.2 Additional brake control

COMPAX controls the motor retaining brake independently (also refer to page35). When running applications which require additional brake control, note the following, depending on the unit type used.

COMPAX-M / COMPAX 45XXS / 85XXS

For COMPAX-M / COMPAX 45XXS / 85XXS, you must perform measures for suppression. Note the following application example:



These protective measures are available in COMPAX-M / COMPAX 45XXS / COMPAX 85XXS for applications without external brake control.

COMPAX 25XXS / COMPAX 35XXM

In COMPAX 25XXS (X1/7 and X1/8) and in COMPAX 35XXM (X23: bridge), 2 connections are available for connecting the contact. These connections are bridged in the connector when supplied.

External protective measures are not required for COMPAX 25XXS and COMPAX 35XXM.

External contact connection:

The bridge is removed and is replaced by connecting an external contact.

6.8.1 Resolver / SinCos

Pin from X12	Assignment
1	Housing
2	+8V
3	NC
4	REF-
5	SIN-
6	NC
7	GND
8	ST+
9	+5V
10	TEMP
11	COS-
12	COS+
13	SIN+
14	REF+
15	ST-

6.9 Interfaces

6.9.1 Digital inputs and outputs

The inputs and outputs have SPS voltage level
(High signal = 24V DC)

Connection assignment of X8 (input/output)

X8

plug: Phoenix
MC1,5/16-ST-3,81



Pin X8	designation	function	
		E1 = 0	E1 = 1
1	input I1	SHIFT	
2	input I2	hand +	MN search
3	input I3	hand -	RN search
4	input I4	quit	teach zero
5	input I5	start	
6	input I6	stop	break
7	input I7	in standard configuration free	
8	input I8		
9	output O1	no error	
10	output O2	no warning	
11	output O3	MN reached	
12	output O4	ready to start	
13	output O5	ref. pos. reached	
14	output O6	out of action after stop	
15	output O7	in standard configuration free	
16	output O8		

➡ The "SHIFT signal" (I1) must be assigned before or at the same time as the relevant input.

Connection assignment of X10 (input/output)

X10

plug: Phoenix
MC1,5/16-ST-3,81



pin X10	designation	function
1	input I9	in standard configuration free
2	input I10	
3	input I11	
4	input I12	
5	input I13	
6	input I14	
7	input I15	
8	input I16	
9	output O9	
10	output O10	
11	output O11	
12	output O12	
13	output O13	
14	output O14	
15	output O15	
16	output O16	

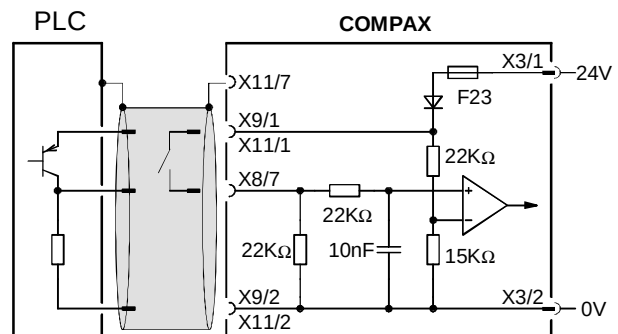
➡ Note the assignment for unit variants and for special functions.

Loading the outputs:

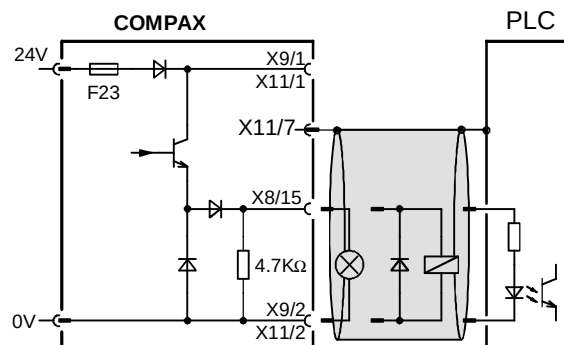
1.	O1...O16	Total of max. 1.6A
2.	O1...O4, O5...O8, O9...O12, O13...O16	Per group of 4, max. 0.8A; taking due account of 1.
3.	A	per output max. 0.3A; taking due account of 1. and 2.

If overload occurs, an error message appears (E43: can be acknowledged with Power off/on); the corresponding group of four is switched off.

Example: Input switch operation using I7



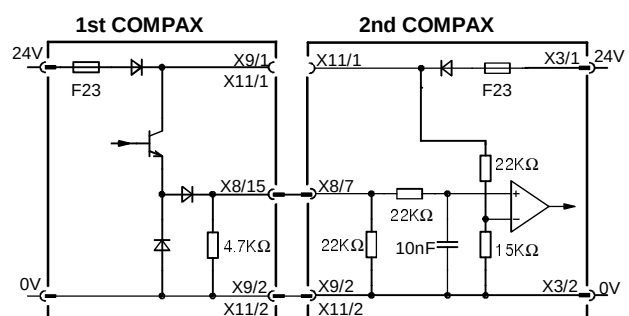
Example: Output switch operation using O7



➡ For reasons of interference protection, we would recommend that you use a sheathed cable for the digital inputs and outputs.

➡ A protective switch operation is required when there is inductive load present.

In-/output switch operation for 2 COMPAXs

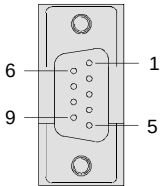


6.9.2 Initiators and D/A monitor (option D1)

Connection assignment on X17

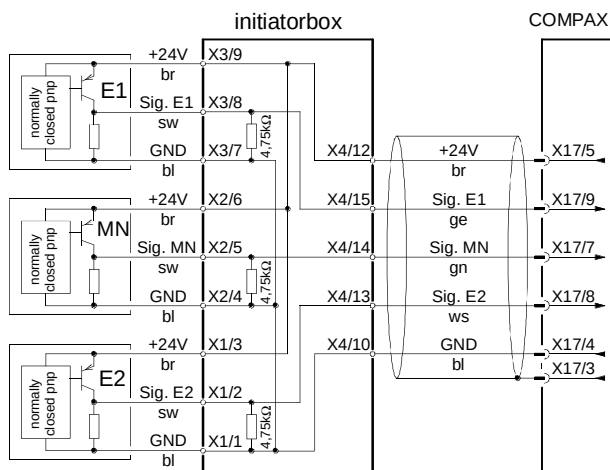
X17

9-way. Sub-D-pin plug housing with screw connection UNC4-40



Pin X17	designation	function
1	DA0	DA-monitor 0 output Ri = 2,8 kΩ
2	DA1	DA-monitor 1 output Ri = 2,8 kΩ
3	shield	
4	GND 24V	supply initiators
5	+24V	supply initiators (<50mA)
6	GND	ref. point for DA0 and DA1
7	Sig. MN	input MN-initiator
8	Sig.E2	input E2-initiator
9	Sig E1	input E1-initiator

Connection plan for the initiators with initiator connector



➡ Ensure that the initiator is rebound-free.

Requirements concerning the position of the initiators

Standard

When **operating with one initiator** (machine zero), this must be attached to one side of the stroke. When attaching the initiator, ensure that an initiator attached to the left-hand side can no longer be cleared to the left. The flank to be analyzed, can therefore be positioned before the end of the travel distance. The same applies correspondingly for the right-hand side.

Extended operation

When **operating with three initiators** (not standard), initiators E1 and E2 must be attached to the outer limits of the stroke range. The machine zero initiator is fitted between E1 and E2. The following limitation applies in such instances: the flank of the machine zero initiator must not be activated at the same time as a limit switch.

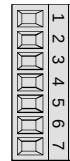
➡ If COMPAX is only operating as a speed controller or in the "continuous mode" or in normal operating mode with a special machine zero mode (P212="10" refer to page 57 onwards), then no initiators are required.

6.9.3 Service D/A monitor / override

Assignment of X11

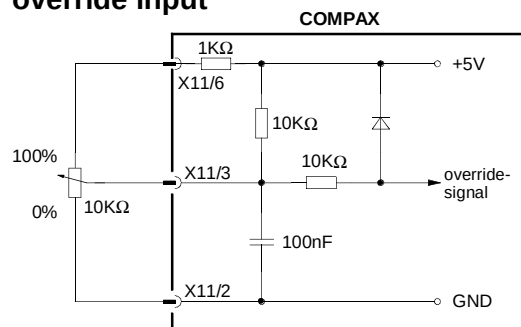
X11

plug: Phoenix MC1,5/7-ST-3,81



pin X11	designation	function
1	+24V	voltage supply (output<50mA)
2	GND 24V	voltage supply (output)
3	Override	speed reduction external
4	DA-channel 2	8 Bit-service-DA-monitor Ri = 2,8 kΩ
5	DA-channel 3	8 Bit-service-DA-monitor Ri = 2,8 kΩ
6	override	previous input for existing applications
7	shield	

Potentiometer switch operation of the override input



➡ The override input is read in a cycle of 100 ms.

You can continue to use the previous override switch operation for current applications.

Attention: Only wire up the override with sheathed lines

6.9.4 Service D/A monitor

The service D/A monitor gives you the options of outputting measuring and intermediate parameters via X11 from COMPAX in the form of analogue voltage in the range of $\pm 10V$ and visualizing these by means of an oscilloscope. This provides you will a capable aid for making the unit's function clear and qualifiable, especially during the start-up. This function (which is available in all units) provides you with two analogue output channels with a resolution of 8 bit and these are updated every 100 microns.

Using the parameters P76 and P77, you can selected 2 parameters and adapt them to the desired measuring range.

Assignment of the channels

Channel 2: X11/4; Channel 3: X11/5

Meaning and range of values of P76 / P77

No.	Parameter	Range
P76 Value before the decimal point	Measuring parameter of channel 2. (see below for meaning).	0...18
P76 Value after decimal point ¹	Gain factor from channel 2. (factor = value x 10 000 000)	0.1... 10 000 000
P77 Value before decimal point	Measuring parameter of channel 3. (see below for meaning).	0...18
P77 Value after decimal point	Gain factor from channel 3. (factor = value x 10 000 000)	0.1... 10 000 000

➡ The parameter can only be actuated once you have entered the password. They are validated using VP.

D/A monitor standard measuring parameters

Service D/A monitor: Selection of measuring parameter using P76 / P77

D/A monitor (option D1): Selection of measuring parameter using P73 / P74
(refer to next page)

1.0000001=factor 1
.000001=factor 10
.999999=factor 10 000 000

Measuring parameter no.	Measuring parameter	Reference value ²
0	Nominal speed value sensor	20 000 rpm
1	Lag error	128 motor revolutions
2	Advance speed control	20 000 rpm
3	Nominal speed value of position controller	20 000 rpm
4	Actual speed value	20 000 rpm
5	Loop difference for speed	20 000 rpm
6	not assigned	
7	not assigned	
8	Nominal value of transverse current (torque) ³	200A
9	Intermediate circuit voltage	1000V
10	Sine for co-ordination transformation	
11	Voltage positioning signal for phase U	2* U _{LS}
12	Voltage positioning signal for phase V	2* U _{LS}
13	Phase current for phase U	200A
14	Phase current for phase V	200A
15	Actual value of transverse current (torque) ⁴	200A
16	Longitudinal current	200A
17	Normalized transverse voltage (For amplification of 1 use: 10V = 2* U _{LS})	2* U _{LS}
18	Standardized longitudinal voltage (For amplification of 1 use: 10V = 2* U _{LS})	2* U _{LS}

You will find additional measuring parameters on page 163!

- Physical value with 10V output voltage and an amplification of 1
- To determine torque:
torque = 3*transverse current *0.71*torque constant
- To determine the torque:
torque = 3*transverse current *0.71*torque constant

Calculation of physical parameter using the measured value:

$$PG = \frac{MW \cdot BG}{VS \cdot 10V}$$

PG: physical parameter

MW: voltage on output channel in [V]

BG: reference value from the above table

VS: gain factor

Example: P76 = 4.000 0010P77 = 13.000 0005

Therefore the following applies:

channel 2: measuring parameter 4 (actual speed value).

gain factor = 10

channel 3: measuring parameter 13 (phase current for phase U).

gain factor = 5

measured values:

channel 0:

$$MW=2.5V \Rightarrow PG = \frac{2,5 \cdot 20000 \text{ min}^{-1}}{10 \cdot 10V} = 500 \text{rpm}$$

$$\text{channel 1: } MW = 3V \Rightarrow PG = \frac{3 \cdot 200A}{5 \cdot 10V} = 12A$$

The parameters of the D/A monitor can also be set to status S15 or be viewed via the optimization display (refer to page101).

Meaning and range of values of P71 - P74

No.	Parameter	Range
P71	Gain factor from channel 0.	1...10 000
P72	Gain factor from channel 1.	1...10 000
P73	Measuring parameter of channel 0. (For the meaning, refer to the table on page 38).	0...18
P74	Measuring parameter of channel 1. (For the meaning, refer to the table on page 38).	0...18

➡ The parameters can only be actuated once you have entered the password.

The measuring parameters are selected using P73 or P74

Example:

P71=10 P72=5 P73=4 P74=13

Meaning:

channel 0: measuring parameter 4 (actual speed value).

gain factor = 10

channel 1: measuring parameter 13 (phase current for phase U).

gain factor = 5

6.9.5 D/A monitor option D1

This option provide you with two additional analogue output channels with a resolution of 12 bit. These channels are updated every 100 microns. You can use the parameters P73 and P74 (as you do with the service D/A monitor) to select 2 quantities and to adapt them to the desired measuring range using 2 parameters (P71 and P72).

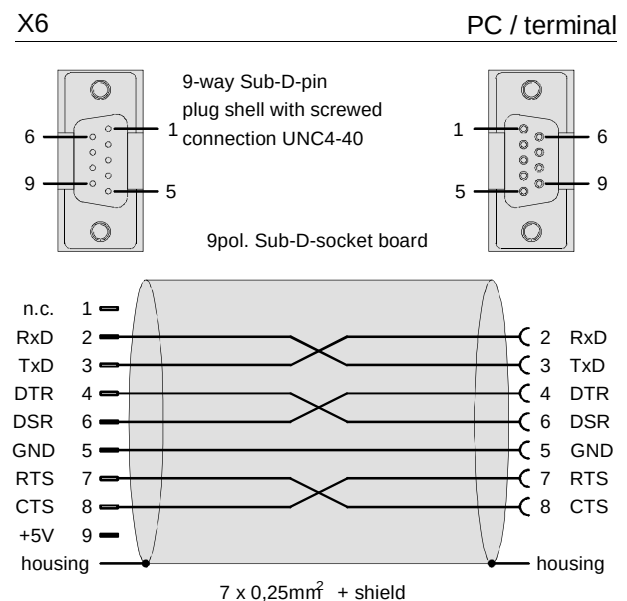
D/A monitor option D1 must be ordered as a separate item.

To obtain output from the measured signals, you will need an externally connected monitor box (ASS1/01) with 2 BNC bushes for connecting the measurement instruments. This is connected as follows:

- ◆ monitor box is connected to COMPAX connector X17.
- ◆ the initiator line is connected from X17 to the monitor box. The signals are fed through the monitor box.

6.9.6 RS232 interface

Wiring diagram SSK1/...: COMPAX - PC/terminal



➡ Fit sheath flat to both sides.

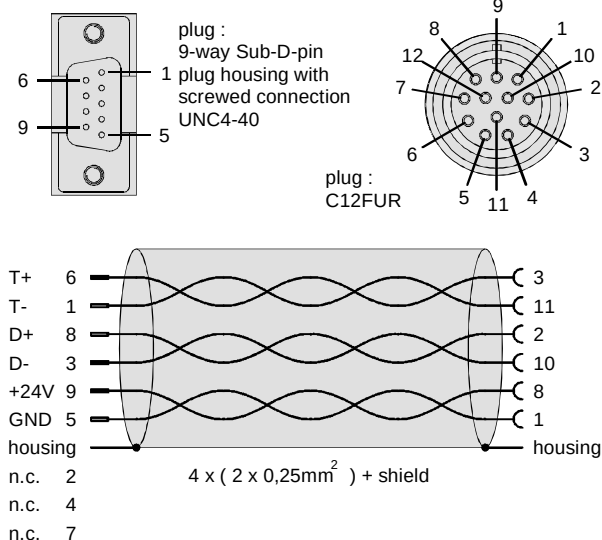
6.10 Options

6.10.1 Absolute value sensor (option A1)

Wiring plan GBK1/...: COMPAX absolute value sensor

X16

absolute encoder

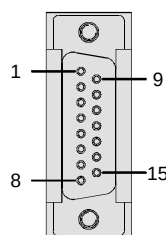


6.10.2 Incremental encoder

Connection assignment on X13

X13

15-way Sub-D-pin screwed connection UNC4-40



pin X13	designation	function
1	housing	shield-connection
2	N2	channel 2 zero pulse
3	B2	channel 2 track B
4	A2	channel 2 track A
5	N1	channel 1 zero pulse
6	B1	channel 1 track B
7	A1	channel 1 track A
8	+5V	output +5V
9	N2/	channel 2 zero pulse inverted
10	B2/	channel 2 track B inverted
11	A2/	channel 2 track A inverted
12	N1/	channel 1 zero pulse inverted
13	B1/	channel 1 track B inverted
14	A1/	channel 1 track A inverted
15	GND	ref. point

➡ The "Incremental encoder" function is an option; if used, you will need additional boards. If the relevant options are available, the following applies:
channel 1: encoder input.
channel 2: encoder emulation

We supply the relevant cables and a bus distributor for wiring up the encoder signals. You can use these to implement various applications (refer to Accessories / options).

➡ When working with COMPAX XX6X (electronic transmission) and COMPAX XX70 (electronical curve control) variants, you can use option E7 via channel 0 to implement an analogue speed specification (refer to page 148).

6.10.3 HEDA interface (option A1/A3)

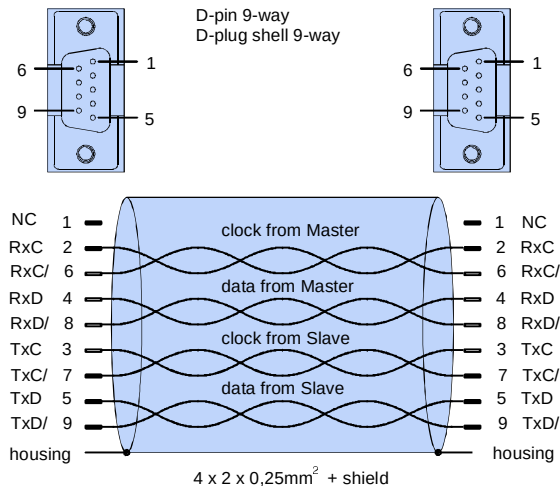
➡ The HEDA interface is available for COMPAX XX00, COMPAX XX60 and COMPAX XX70.

SSK14 wiring diagram/...: IPM - COMPAX and COMPAX - COMPAX

Layout:

X14/PC

X15



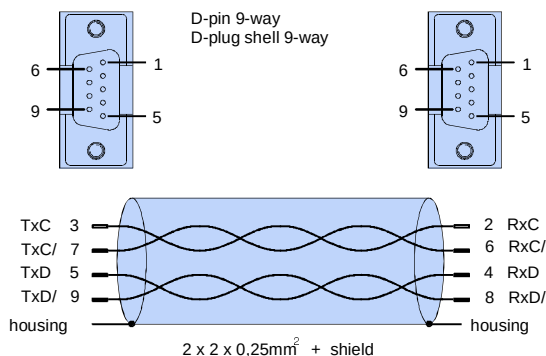
SSK14 must not be used on a COMPAX which is configured as a master (P243=1).

Cables for the coupling between COMPAX master and COMPAX slave:

SSK15/..

Master: X15

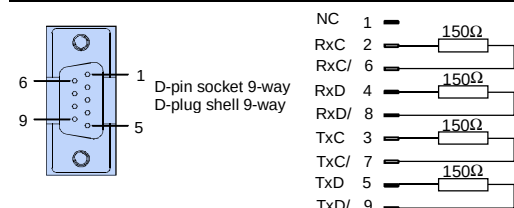
Slave: X14



The last unit on the HEDA has a terminating connector (BUS2/01).

Layout:

X15 BUS 2/01



6.10.4 Single-phase power supply

➡ Option N1 single-phase power supply is only available for COMPAX P1XXM.

Safety chain and emergency stop function X9

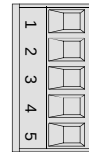
refer to page 34

Mains supply lineto the upper side of the unit

X19

plug: Phoenix

MSTB2,5/5-ST-5,08



pin	designation
1	L1
2	N
3	PE
4	+24V
5	0 (GND)

6.10.5 Bus connection

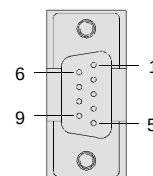
Connection assignment to connector "IN"

NMD / COMPAX 35XXM: X6

COMPAX-S: X5

X6 / X5

9-way Sub-D-pin plug shell with screwed connection UNC4-40

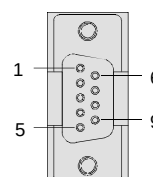


pin X5/6	Interbus-S option F2	RS485		Profibus option F3	CAN Bus option F4
		option F1	option F5		
1	DO1	RxD	n.c.	n.c.	n.c.
2	DI1	TxD	RxD/TxD	Data+	CAN-L
3	GND1	GND1	GND1	GND1	CANGND
4	n.c.	n.c.	n.c.	n.c.	n.c.
5	n.c.	n.c.	n.c.	n.c.	n.c.
6	DO1	RxD	n.c.	n.c.	CANGND
7	DI1	TxD	RxD/TxD	Data-	CAN-H
8	n.c.	n.c.	n.c.	n.c.	n.c.
9	n.c.	n.c.	n.c.	n.c.	n.c.

Connection assignment of connector "OUT"
NMD, COMPAX 35XXM and COMPAX-S

X7 / X7

9-way Sub-D-pin plug shell with screwed connection UNC4-40



pin X7	Interbus-S option F2	RS485		Profibus option F3	CAN Bus option F4
		option F1	option F5		
1	DO2	RxD	n.c.	n.c.	n.c.
2	DI2	TxD	RxD/TxD	Data+	CAN-L
3	GND2	GND	GND	GND1	GND
4	n.c.	n.c.	n.c.	n.c.	n.c.
5	+5V	n.c.	n.c.	n.c.	n.c.
6	DO2	RxD	n.c.	n.c.	CANGND
7	DI2	TxD	RxD/TxD	Data-	CAN-H
8	n.c.	n.c.	n.c.	n.c.	n.c.
9	RBST	n.c.	n.c.	n.c.	n.c.

➡ The bus interfaces are options; they are not possible on COMPAX P1XXM if you are also using the N1 option.

Special operating instructions are available for the bus systems.

6.11 Technical data

Power features

Scope of function

- ◆ Position, speed and current controller.
- ◆ IGBT final stage protected from short circuits and ground/earth.
- ◆ Digital positioning controller.
- ◆ Movement control.

Supported motors / resolvers

- ◆ Sine-commuted synchronous motors up to a max. speed of 9000 rpm.
- ◆ Asynchronous motors.
- ◆ Supported resolver:
 - Litton: JSSBH-15-E-5
JSSBH-21-P4
RE-21-1-A05
RE-15-1-B04
 - Tamagawa: 2018N321 E64
 - Siemens: 23401-T2509-C202
- ◆ Support of SinCos (Stegmann).

Output data from the individual units

Unit COMPAX ..	Nominal current [A _{eff}]	Peak current [A _{eff}] <5s	Output [kVA]
at mains supply: 230V AC			
25XXS	6.3	12.6	2.5
P1XXM N1	7.0	8.5	2.8
at mains supply: 400V AC			
45XXS	6.5	13.0	4.5
85XXS	12.5	25.0	8.6
P1XXM	5.5	8.5	3.8
02XXM	6.5	8.5	4.5
05XXM	11.5	17.0	8.0
15XXM	25.0	50.0	17.0
35XXM	50.0	100.0	35.0
at mains supply: 460V AC			
45XXS	5.4	13.0	4.5
85XXS	10.5	25.0	8.6
P1XXM	4.5	8.5	3.8
02XXM	5.4	8.5	4.5
05XXM	9.6	17.0	8.0
15XXM	21.0	50.0	17.0
35XXM	42.0	100.0	35.0

CE conformity

- ◆ EMC susceptibility / emissions in acc. with EN61800-3.
- ◆ Safety: VDE 0160 / EN 50178.

Mains power

COMPAX-M (NMD)

- ◆ 3*80V AC - 3*500V AC; 45-65 Hz.

COMPAX 35XXM

- ◆ 3*250V - 3*500V AC; 45-65 Hz.

COMPAX 25XXS

- ◆ 3*80V AC - 3*250V AC; 45-65 Hz
- 1*100V AC-1*250V AC; 45-65 Hz

COMPAX 45XXS/85XXS

- ◆ 3*340V AC - 3*500V AC; 45-65 Hz.
- with external 24V DC: 3*80V AC - 3*500V AC.

Mains supply fuse protection

External cutout or cartridge fuse-link.

- ◆ NMD (COMPAX-M)
 - NMD10: 16A (cutout: 20A)
 - NMD20: 35A
- ◆ COMPAX 35XXM: 62A
- ◆ COMPAX 25XXS: 1*230V AC: 16A
3*230V AC: 10A
- ◆ COMPAX 45XXS/85XXS: 16A

DC current

- ◆ 300V DC with 3(1)*230V AC.
- ◆ 560V DC of 3*400V AC supply.
- ◆ 650V DC with 3*460V AC.

Output voltage on motor

Ignoring power losses, motor output rating is 86% of the AC supply voltage available

Braking operation

- ◆ Energy which can be stored
 - NMD10/20: 1100μF / 173 Ws
 - COMPAX 25XXS: 1000μF / 27 Ws
 - COMPAX 45XXS: 330μF / 52 Ws
 - COMPAX 85XXS: 500μF / 80 Ws
- ◆ Ballast resistances
 - NMD10: internal
 - NMD20: internal / external
 - COMPAX 35XXM: external
 - COMPAX 25XXS: external
 - COMPAX 45XXS/85XXS: internal / external

Control voltage

- ◆ 24V DC $\pm 10\%$, ripple $< 1V_{SS}$
- Current required:
 - 1.3A for COMPAX 35XXM.
 - 1A for COMPAX 45XXS/85XXS.
 - 0.8A for the other unit.
 - digital outputs, each 100 mA.
 - if nec, for fan approx. 100 mA.
 - for motor retaining brake (0.35A-1.6A).
 - if nec., absolute value sensor: 0.3A.

Precision

- ◆ Positioning on the motor shaft:
Resolution: 16 bit (= 0.3 minutes of angle)
Absolute precision: ± 15 minutes of angle.

Maximal power losses

- ◆ COMPAX P1XXM: 140W
- ◆ COMPAX 02XXM / NMD10/20: 120W
- ◆ COMPAX 05/10/15XXM: 250W
- ◆ COMPAX 25XXS: 80W
- ◆ COMPAX 45XXS/85XXS: 170W
- ◆ COMPAX 35XXM: 610W

Data block memory

250 data records, protected from power failure.

Data record functions

- ◆ Positioning commands, I/O instructions, program commands:
ACCEL, SPEED, POSA, POSR, WAIT, GOTO, GOSUB, IF, OUTPUT, REPEAT, RETURN, END, WAIT START, GOTO EXT, GOSUB EXT, SPEED SYNC, OUTPUT O0, GOTO, POSR SPEED, POSR OUTPUT , +, -, *, /.

Nominal value generator

- ◆ Ramps: linear, quadr., smooth; 10ms...60s.
- ◆ Travel specified in increment, mm, inch or variable using a scaling factor.

Monitoring functions

- ◆ Mains power / auxiliary voltage range.
- ◆ Motor and final stage temperature / blocking protection.
- ◆ Lag error monitoring.
- ◆ Ready contact: 0.5A; 60V; 30W.

Ambient conditions

- ◆ Temperature range: 0...45 °C.
- ◆ Max. relative air humidity in acc. with DIN 40040 class F ($\leq 75\%$); no thawing.

Interfaces**Control inputs: 16**

- ◆ 24V DC / 10 kOhm.

Control outputs: 16

- ◆ active HIGH / protected from short circuits / 24V / 100 mA.

RS 232

- ◆ 9600 Baud or 4800 Baud.
- ◆ Length of words 8 bit, 1 start bit, 1 stop bit.
- ◆ Software handshake XON, XOFF.

SPS data interface

- ◆ Via 5 binary inputs and outputs.

Encoder interface (option)

- ◆ Encoder emulation: (512 /1024 inc./revol.)
- ◆ Encoder input: RS422 interface; supply: 5V 120-5000 inc./revol..

Absolute value sensor interface (option)

- ◆ Supply voltage: 24V $\pm 10\%$.
- ◆ Sensing code: gray code, single step.
- ◆ Direction of counting: in clockwise direction when looking at the shaft: rising.
- ◆ Data interface: RS422 /24 bit data format (start: MSB). • Cycle frequency: 100 kHz.

SinCos (option S1/S2)

- ◆ High-resolution sensor instead of resolver.
- ◆ Singleturn or Multiturn (absolute value via 4096 motor revolutions).
- ◆ Option S2 with Multiturn: absolute value sensor with programmable transmission factor.

Bus connections; optionally

galvanically separated bus link.

RS485

- ◆ max. 115k Baud • 2 or 4 wires- RS485

Interbus S

- ◆ 2-conductor remote bus • 500 k Baud.
- ◆ max. 64 participants per ring.

Profibus

- ◆ 1.5M Baud • Sinec L2-DP and FMS.

CS31

- ◆ COMPAX – ABB – interface.

CAN bus

- ◆ up to 1.0M Baud • BasisCAN.
- ◆ CAN protocol in acc. with specification 1.2.
- ◆ Hardware in acc. with ISO/DIS 11898

CANopen

- ◆ Protocol in acc. with CiA DS 301.
- ◆ Profile CiA DS 402 for drives.

Operation

Parameter input / status query

- ◆ Via COMPAX hand-held terminal.
- ◆ Via RS232 and via bus interface.
- ◆ Via the SPS data interface.
- ◆ Additional status query via the 3 digit LED display of the front plate.

Housing

Housing

- ◆ Sealed metal housing.
- ◆ Insulation: VDE 0160 / protection class IP20.

Connections

- ◆ Motor, power bus, control inputs/outputs via terminals.
- ◆ Sensor cables, interfaces via connectors.

Installation

- ◆ Wall installation, suitable for installation in industrial control cabinets.

Dimensions

- ◆ NMD / COMPAX-M: refer to page 20.
- ◆ COMPAX 25XXS: refer to page 29.
- ◆ COMPAX 45XXS/85XXS: refer to page 31.
- ◆ Weights: COMPAX P1XXM: 5.6 kg
COMPAX 25XXS: 4.6 kg
COMPAX 45XXS/85XXS: 6.5 kg
COMPAX 02XX: 7.1 kg
COMPAX 05/15: 7.8 kg
COMPAX 35XXM: 22.5 kg
NMD10: 7.6 kg
NMD20: 8.1 kg

Standard scope of supply

- ◆ COMPAX with User Guide.
- ◆ X8, X9, X10, X11 mating connectors.
- ◆ One ServoManager per order.

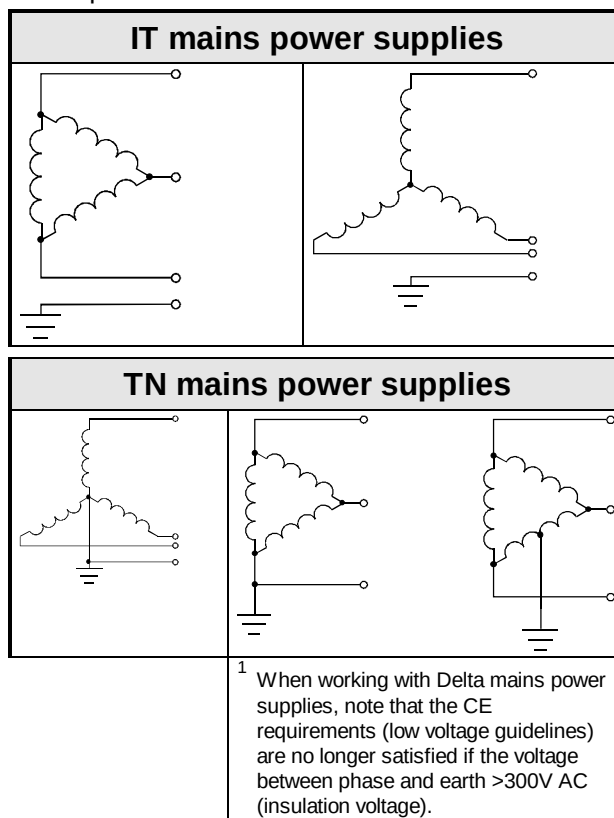
Mains power control module

For technical data, refer to page 22.

Permissible 3-phase mains

The units (COMPAX or NMD) can be operated on all types of mains power supplies¹:

Examples:



Leakage current

The leakage current (current on the mains power supply PE) is mainly caused by the capacitive resistance which exists between the conductor and sheathing of the motor cable. Additional leakage current arises when using a radio suppresser since the filter circuit is connected with earth via the condensers.

The size of the leakage current depends on the following factors:

- ◆ length of motor cable.
- ◆ cycle frequency.
- ◆ with or without radio suppresser.
- ◆ motor cable sheathed or not.
- ◆ motor earthed at site or not.

The leakage current is very important for the levels of safety attained when handling and operating the unit.

Please note

The unit must be operated with an effective earth connection which satisfies the appropriate specifications for high levels of leakage current (>3.5 mA).

The Servo booster must not be operated with a fault current protected switch due to the risk of higher levels of leakage current. If an FI - protected switch is installed, it must not interrupt the current circuit regardless of the following conditions (e.g. from ABB series F804):

- ◆ DC unit in leakage current (3-phase rectifier bridge).
- ◆ Brief appearance of pulse-shaped leakage currents when switching on.
- ◆ High levels of leakage current.

7. Operating instructions

Compact Servo control

7.1 Overview

The COMPAX digital positioning system has been designed for multi-axis applications in handling and automation technology. COMPAX contains all the functions required for a compact positioning system. These functions are:

- ◆ digital inputs and outputs (SPS interface)
- ◆ a serial interface (RS232)
- ◆ a natural language memory
- ◆ an integrated IGBT final stage.

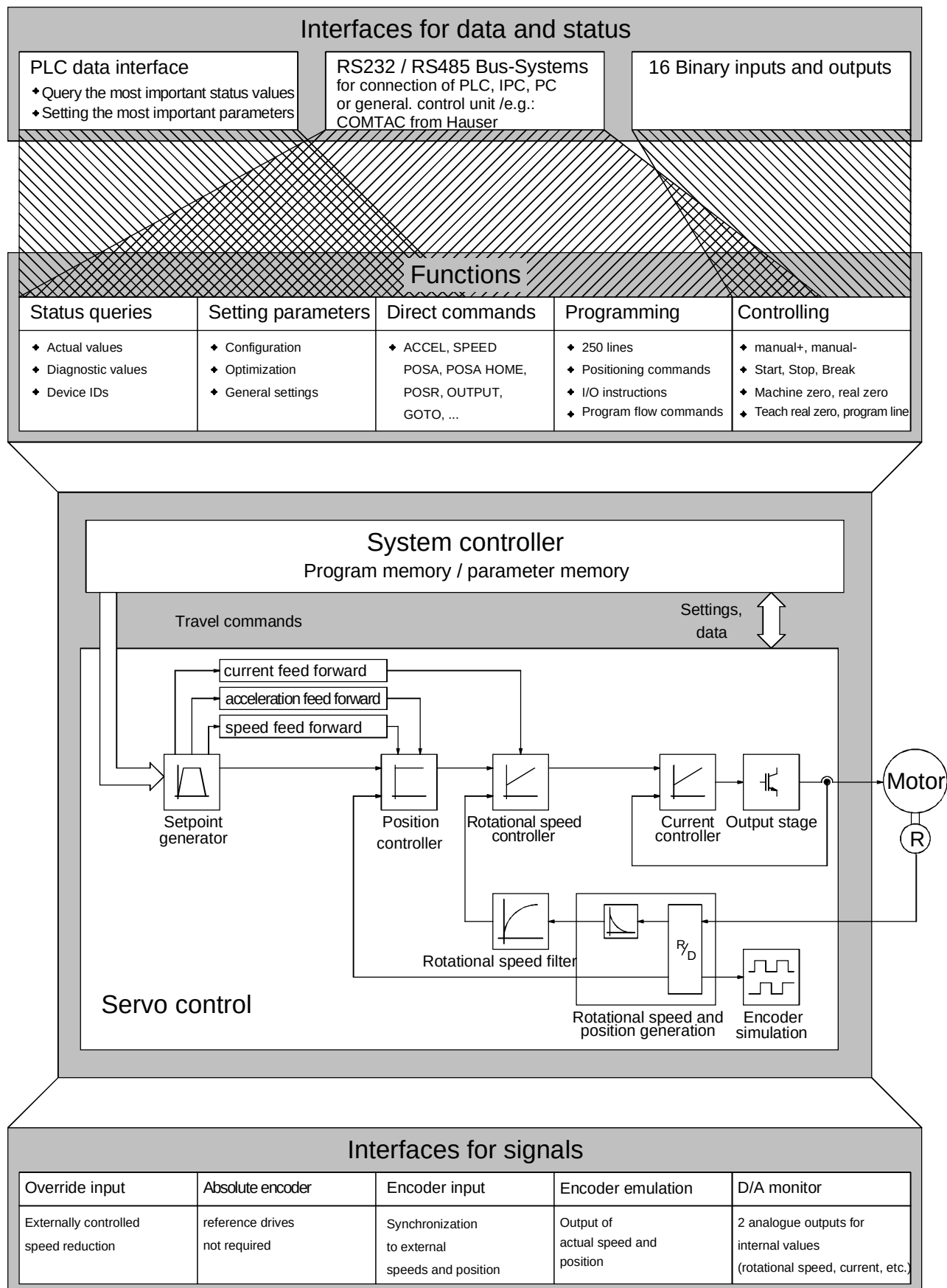
You will need aids (PC, hand-held terminal) to configure and program COMPAX.

COMPAX is very flexible and offers all the advantages of digital control technology thanks to its completely digital design which encompasses positioning, speed and current control. The main features of digital control technology are:

- ◆ controller parameters which can be reproduced and are drift-free
- ◆ simple copying of set values
- ◆ no offset problems
- ◆ the implementation of efficient, flexible and adaptable nominal value generation.

Unit hardware	Connector assignment / cable	Technical data	Configuration	Positioning and control functions	Optimization functions	Interfaces	Accessories / options	Status	Parameters	Error list
---------------	------------------------------	----------------	---------------	-----------------------------------	------------------------	------------	-----------------------	--------	------------	------------

7.1.1 Block structure of the basic unit



Explanations for the block structure

Interfaces for data and status

SPS data interface	The following commands are available via 5 binary inputs (I7...I11) and 5 binary outputs (O7...O11): POSA, POSR, SPEED, ACCEL, GOTO, VP, modifying parameters P1..P49, querying status S1...S12.
RS232	All functions are available via RS232.
Bus systems	All functions are available via the bus interface (Interbus S, Profibus, CAN bus, CANOpen, CS31 or RS485 (ASCII/binary with 2 or 4 wires). A description is available as a separate item.
Binary inputs and outputs	Inputs: I1...I6: control functions or can be freely assigned. I7...I16: can be freely assigned or can be programmed. Outputs: O1...O6: control outputs or can be freely assigned. O7...O16: can be freely assigned or can be programmed.
Functions	
Querying status	The status can be queried via the SPS data interface, the bus interface and partially via the front plate display.
Setting parameters	
Configuring	Operating mode, units for travel data, motor types, ramp shapes, directions, drive types, reference systems, ...
Optimizing	Via the uncoupled rigidity, damping and advance control parameters.
General settings	Substitute and specification values, limitations, control parameters.
Programming data records	Programming a sequential program with up to 250 data records.
Controlling	Functions: manual mode, start, stop, break, teach functions Messages no fault, no warning, machine zero has been approached, ready for start, position reached, idle after stop or break, . Program control: external data record selection, analyzing binary inputs, setting binary outputs, triggering positioning processes,... .
System controller	Function monitoring and co-ordination
Control	Digital control with robust loops. Automatic calculation from existing design quantities.

Interfaces for signals

Override input	Analogue input (X11.6 refer to start-up manual) for continually reducing the set speed.
Absolute value sensor (option)	This option supports an absolute value sensor attached to the motor; reference travel is therefore no longer required after initialization has been performed once (refer to the start-up manual and Accessories and options).
HEDA (option)	Real time data channel For implementing track and contour tasks using the HAUSER "IPM" interpolation module for PC and IPC or for direct COMPAX - COMPAX coupling with one COMPAX as the master.
Encoder input (option)	COMPAX can be synchronized to an external speed (and/or position, e.g. with the "Electronic transmission unit variant) via this input (refer to the start-up manual and Accessories and options).
Encoder emulation (option)	The actual position value can be made available to other units via this channel (refer to the start-up manual and Accessories and options) . An encoder bus can also be established. (refer to the description in " Accessories and options ")
D/A monitor	18 internal measuring and intermediate parameters are output as analogue voltage (+/-10V) via two 8 bit channels (or optionally 12 bit channels).

7.1.2 Password protection

COMPAX contains password protection to prevent undesired manipulation of your data. Before you configure COMPAX or set your parameters, you must release these functions with a password. Provided that the axis is at a standstill, proceed as follows to perform releasing and blocking:

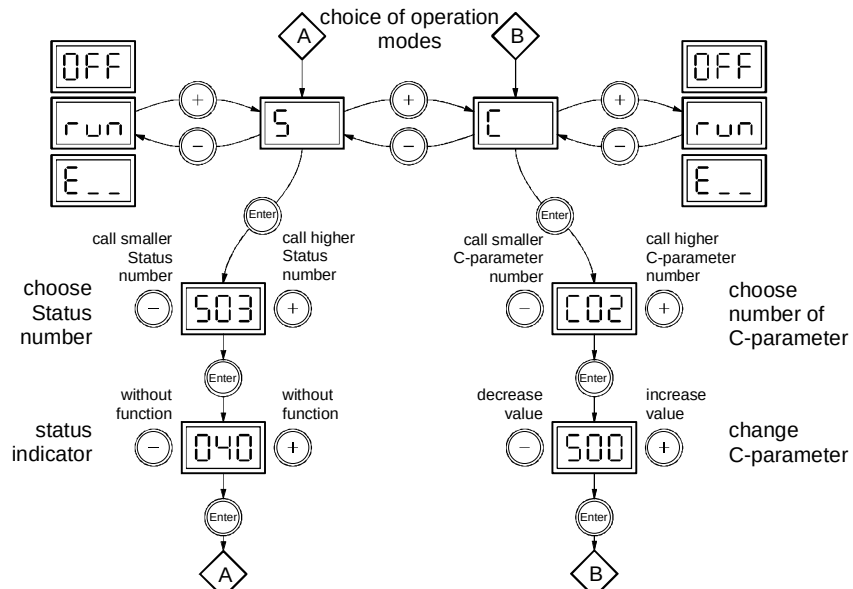
Deactivate password protection:	◆ transmit GOTO 302 to COMPAX
Activate password protection:	◆ switch the unit off or ◆ transmit GOTO 270 to COMPAX.
Protected parameters	All parameters, except P40-P49 are protected by password.  The COMPAX program is not protected by a password.
Note!	Conditions for password input : ◆ There must not be any programs running.

7.2 Configuration

7.2.1 Front plate operation

Using the COMPAX front plate, you can query particular status values and perform the most important bus settings. Also whenever an error occurs, COMPAX shows the error number on the display.

Querying status values and modifying the bus parameters.



The following status values can be displayed via the front plate:
S03-S08, S11, S19-S26 (hexadecimal display), S27, S30, S31, S37-S39
(description of the status values: refer to page 160).
The remaining status values can be queried via the interfaces.

Meaning of the
bus parameters:

C parameters	COMPAX parameters	Meaning	Valid as of
C01	P194	Address of unit	Power on
C02	P195	Baud rate:	Power on
C03	P196	Bus protocol	Power on
C11	P250	HEDA address	immediately
C04 - C10		reserved	

Display value	Baud rate [Baud]	Display value	Baud rate [Baud]	Display value	Baud rate [Baud]
0	600	31	31 250	172	172 800
1	1200	38	38 400	187	187 500
2	2400	50	50 000	250	250 000
4	4800	57	57 600	345	345 600
9	9600	62	62 500	375	375 000
10	10 000	76	76 800	500	500 000
19	19 200	100	100 000	800	800 000
20	20 000	115	115 200	999	1 000 000
28	28 800	125	125 000		



Please refer to the operating instructions of the bus option used for the relevant range of values and the precise setting options.

Acknowledging
error messages

Once you have rectified the cause of the error, you can acknowledge the error by pressing the "Enter" key.

7.2.2 Configuration when supplied

When supplied, COMPAX is not configured. When supplied, parameter P149 is set to "0":

P149="0": COMPAX is not configured and switches to OFF mode when switched on (24V DC and operating voltage) (motor switched off). In addition to this, when switched on, all parameters (apart from bus settings P194, P195, P196 and P250) are set to their standard values.

P149="1": COMPAX is configured and once switched on (24V DC and operating voltage) tries to engage the motor.



If you are configuring using ServoManager, P149 is automatically set to "1" once ServoManager has performed successful configuration.

Feedback controller draft concept

To operate the COMPAX feedback controller draft concept you must have a minimum level of technical control knowledge. COMPAX calculates the internal system and controller parameters required using simple, application-specific values, which are usually accessible.

A robust feedback controller draft design obviates the need for what used frequently to be a tedious optimization run. This configuration provides you with a stable controller.

Power on with motor switched off

If the control process is unstable because COMPAX has been incorrectly configured, you can switch on COMPAX so that the drive remains switched off even with power on. To do this, when switching on COMPAX simultaneously press the "-" key. The following will then happen:

- ◆ the drive is switched off.
- ◆ the digital outputs O1...O6 are set to "0".
- ◆ when the SPS data interface is switched on: O7=1, O8..O11=0
- ◆ the password protected functions are approved.

Once you have correctly configured COMPAX or you have rectified the relevant parameters, you can engage the drive and outputs again using the command "OUTPUT O0 = 0".

7.2.3 Configuration process

Switching off the drive



Before you configure COMPAX or modify the configuration, the drive must be switched off e.g. using the OUTPUT O0=1 or 2 command (refer to page 73).

Modifying the parameters

The COMPAX configuration is carried out using parameters and the process is sub-divided as follows:

- ◆ select operating mode.
- ◆ specify the units for the travel data.
- ◆ select the motor from the motor list or configure an external motor.
- ◆ select the ramp shape.
- ◆ define the direction of travel.
- ◆ use the design data to specify the drive type.
- ◆ define the reference system.



The ParameterEditor (part of the ServoManager) automatically guides you into the "managed configuration" menu through the input masks using the configuration settings.

From the next page onwards you will find a description of the configuration process and this is given in a sensible order for anyone performing new configurations. If you follow this process, you will have all the parameters required for your application.

In chapter = "0": MN equal to external initiator rounded to resolver zero & machine zero travel using 2 reversing initiators.", you will find a description of options for machine zero and limit switch configurations which deviate from the standard.



The configuration parameter are not transferred directly once they have been modified. COMPAX will only transfer the new parameters once the VC commands (configuration valid) have been issued.

The ServoManager independently sets the parameters after configuration.

Power on for drive

Using the command OUTPUT O0=0.



Note that once a configuration has been set or modified, there is a risk because you may have incorrectly programmed some of the parameters.

You should therefore especially secure the displacement area of your system by switching on the drive.

7.2.4 Safety instructions for the initial start-up

Risk of incorrect wiring!

In order to avoid the risk of wiring the system incorrectly when initially starting it up, you should use the following settings for your own safety and for the protection of your system:

P15 = 10% (motor speed limited to 10% of its nominal value)

P16 = 100% (torque limited to 100% of its nominal value)

- The drive must remain at a standstill after the system has been switched on.
- Start to operate the system, either with POSR x or manually +/-.

If this travel motion is performed correctly, then you can reset P15 and P16 to their original values.

The following faults may occur, as follows.

- The drive remains at a standstill once switched on, or
- the drive runs out of control when the start command is given.

In both instances, either error E10 or error E54 is triggered.

If error E54 occurs, the drive is switched off.

A possible cause of the error is incorrect wiring in the motor or resolver systems.

7.2.5 Configuration parameters

Operating mode

Parameter P93: valid as of next move command.

Normal mode:

P93 = "1"

Positioning processes refer to real zero.

To set this as the reference, you have to use the "Find machine zero" function (input I1="1" and I2="1" refer to page 112) once the system is switched on.

You will find descriptions of the various machine zero modes from page 57 onwards.

Continuous mode:

P93 = "2"

Positioning processes always refer to the relevant start position.

The "Find machine zero" function is not necessary but possible.

Set P1 (real zero) = 0.

To avoid inaccuracies during conversions, you should use the "Increments" measurement units when working in continuous mode (see below).

 Operation with absolute value sensors is not permitted when working in continuous mode.

Speed controller

P93 = "4":

In this operating mode, the drive controller operates as a speed controller, the position controller is switched off. This means

- ◆ Commands which are not permitted: POSA, POSR, POSR SPEED, POSR OUTPUT, POSA HOME, ACCEL-.
- ◆ The SPEED command contains a prefix for the direction of rotation.
- ◆ Output O3 is not assigned;
O5 has the "Programmed nominal speed reached" function (refer to page 92).
- ◆ The data record indicator is set to N001 using "Approach real zero".
- ◆ The "Find machine zero" function (I1&I2) is not assigned.

Unit for travel data

Parameter P90

mm

P90 = "1"

Inches

P90 = "2"

Increments

P90 = "0": accurate increment operation without conversion inaccuracies.

 This measuring unit is only useful when using the "General drive" drive type and especially when in continuous mode. The levels of accuracy are not increased when working with other drive types.

The "Travel per motor revolution" (P83) is specified in increments.

Meaning: $P83 = 2^n$ when $n = 4, 5, 6, \dots, 16$

This corresponds to a resolution of 16 65 536 increments per motor revolution.

P83 influences the resolution and also the max. travel distance:

The maximum travel distance is limited to ± 4 million units. This corresponds to 61 revolutions at a maximum resolution of 65 536 increments per motor revolution. The maximum travel distance can be increased by reducing P83.

Meaning:

P83	Maximum travel in motor revolutions
16	$\pm 250\,000$
32	$\pm 125\,000$
64	$\pm 62\,500$
128	$\pm 31\,250$
256	$\pm 15\,625$
512	± 7812
1024	± 3906
2048	± 1953
4096	± 976
8192	± 488
16 384	± 244
32 768	± 122
65 536	± 61

In **continuous mode**, this limitation always applies to commands.

In **normal mode**, this limit applies to the entire displacement area.

Motor type

Parameter P100

The motor parameters are required for COMPAX motor-specific settings. The motor parameters of the HAUSER motors recommended for COMPAX are available in a list in ServoManager / ParameterEditor and can be selected from there.

You can configure additional motors using the "External motor" function.

Basic conditions for external motors:

- ◆ Sine-commuted motors (sinusoidal EMC)
- ◆ Resolver / SinCos (refer to the start-up manual under "Technical data" on page 42).



The nominal currents of the motors and units must be adapted. If you are using nominal currents which are small in relation to the unit's nominal currents, the current recording will be less accurate.

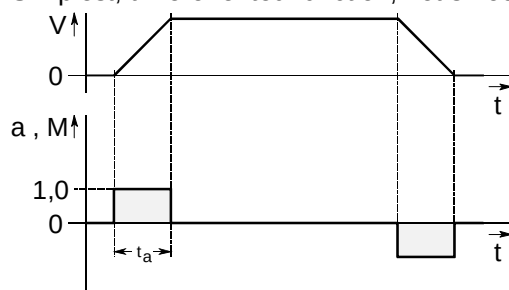
Ramps

linear

Parameter P94

P94="1"

Simplest, time-oriented function; not smooth



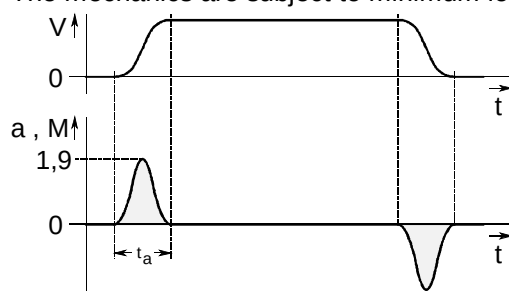
Current requirement: single

Configuration parameters

smooth

P94="2"

The mechanics are subject to minimum load when using the smooth function.

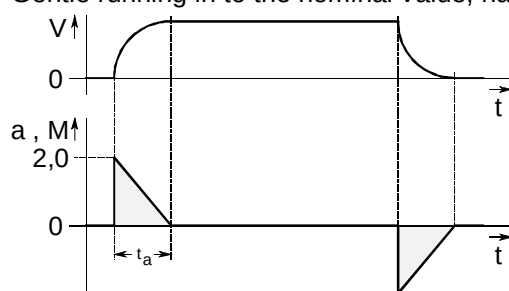


Current requirement: 1.9 times

quadratic

P94="3"

Gentle running in to the nominal value; harmonics are prevented.



Current requirement: double

t_a: ramp time (can be set using the command "ACCEL", refer to page 72)

v: velocity

a: acceleration

M: acceleration torque

Transfer of P94

The modifications to P94 become effective as of the next move command.

Exception:

For the functions:

◆ stop after have travel beyond a limit switch and

◆ synchronous stop via I13 (refer to page 115).

the ramp type is only validated using VC

Drive type:

Parameter P80: selecting drive type

Various data is required for additional configuration depending on the drive type selected. The assignment of the parameters P81 - P85 is thereby modified. Therefore, continue with the configuration using the drive type selected.

Spindle drive:

P80=2:

P81: length

Length of spindle
Range: 300 ... 5000 mm

P82: diameter

Diameter of the spindle
Range: 8 ... 80 mm

P83: Pitch

Pitch per spindle revolution.
Range: 1 ... 400 mm

P85: ratio	Motor / spindle ratio. Range: 1 (1:1)...100 (100:1) $\equiv$ motor : transmission
P84: moment of inertia	Moment of inertia of transmission and clutch referenced to the drive side. Range: 0...200 kgcm ²
P92: Minimum mass	Minimum translated mass moved [kg]. Range: 0...P88
P88: Maximum mass	Maximum translated mass moved in [kg]. Range: 0...500 kg

Rack-and-pinion /toothed belts

P80= "4" or "8"

P82: Number of teeth on pinion Range: see under tooth pitch

P83: tooth pitch Distance between two teeth
The range of values for the number of teeth and tooth pitch is determined by the pitch. Meaning: pitch = number of teeth * tooth pitch.
Range of values of the pitch: 1 ... 410 mm

P85: ratio Ratio from motor to rack-and-pinion/toothed belt.
Range: motor : transmission $\equiv$ 1 (1:1)...100 (100:1)

P84: moment of inertia Moment of inertia of transmission and clutch referenced to motor shaft.
Range: 0...200 kgcm²

P92: minimum mass Minimum translated mass moved [kg]. Range: 0...P88

P88: maximum mass Maximum translated mass moved in [kg].
Range: 0...500 kg

HLE / HPLA data for the drive type: "toothed belt"

	HLE80C	HLE100C	HLE150C	HPLAB180 toothed belt	HPLAR180 rack-and-pinion
Number of teeth on pinion (P82)	19	17	24	21	28
Tooth pitch (P83)	10 mm	10 mm	10 mm	20 mm	10 mm

General drive

P80=16:

P81: Minimum moment of inertia Total minimum moment of inertia: motor, transmission and load referenced to the motor shaft.
Range: 0...P82 [kgmm²]

P82: maximum moment of inertia Total maximum moment of inertia: motor, transmission and load referenced to the motor shaft.
Range: P81...200 000kgmm²

P83: travel per motor revolution Range: 10 ... 4 000 000μm
or 16 ... 65 536 increments.

Reference system

Parameter P213: direction of machine zero

(the description provided here is the standard setting, you will find more information

as of page 57)

Standard reference system: no end or reversing initiators; one machine zero initiator at the end of the displacement area

The machine zero initiator must be attached ensuring that it can only be cleared in one direction; i.e. it is attached to one side.

You can use parameter P213 to inform COMPAX of the side on which the MN⁵ (machine zero) initiator is attached.

P213="0": The machine zero initiator is driven by the clockwise rotating motor (when facing the motor shaft).

P213="1": The machine zero initiator is driven by the motor which turns anti-clockwise.

Setting aid

Set P215="0":

Actuate Hand+; the drive moves in the direction of the MN initiator, then the following applies: P213="0", if this is not the case, set P213="1".



The following basic setting applies for this standard reference system (≡ no end or reversing initiators; one machine zero initiator at the end of the displacement area): P212="1", P217="0", P216="0". You will find other options for defining a reference system in the next chapter.

Determining software end limits

You determine the software end limits of the displacement area using parameters P11 and P12. Each time a positioning command is issued, COMPAX checks whether the target is within the travel distance. If this is not the case, error E25 is reported.



When working in continuous mode, these limits always apply for the present positioning process.

P11: maximum position

Range: ±4 000 000 [units corresp. P90]

P12: minimum position

Range: ±4 000 000 [units corresp. P90]

Determining point of real zero (RN)

Absolute positioning commands refer to RN. RN is specified relative to machine zero.



P1 must be set to 0 in continuous mode.

P1: point of real zero

Range: ±4 000 000 [units corresp. P90]

P215: direction of rotation

P215 establishes the positive direction of travel (positive end of displacement area) referenced to the motor's direction of rotation.

P215="0" the motor is turning to the right and traveling in the positive direction

P215="1" the motor is turning to the left and traveling in the positive direction

♦ Clockwise rotating means to the right when looking at the motor shaft.

Setting aid:

Proceed with Hand+; the motor must move in the direction which is defined as being the positive direction. If this is not the case, then P215 has to be modified.



P215 has no influence on the setting of the machine zero direction (P213); provided that it has the same mechanical design.

⁵ MZ: machine zero

7.2.6 Machine zero mode

Overview:

P212: setting the machine zero mode

= "0": MN equal to external initiator rounded to resolver zero & machine zero travel using 2 reversing initiators.

= "1": MN equal to external initiator rounded to resolver zero.

= "3": MN equal to external zero pulse

= "4": MN equal to external initiator rounded to the external zero pulse.

= "5": MN equal to resolver zero

= "6": reserved

= "7": MN equal to external initiator (without resolver zero).

= "8": MN equal to limit switch

= "10": MN teach

P212 becomes valid immediately after a modification.

* ➡ P212=3 & P212=4 is only permitted for COMPAX XX00 and COMPAX XX30.

Function of the machine zero mode

Machine zero equal to external initiator & resolver zero / 2 reversing initiators.

P212="0"

Start search direction / initiator side	Application
P213: defines the initiator flank of the machine zero initiator, which is being evaluated; i.e. the side from which the initiator is approached.	Linear movements
P3: the prefix defines the start search direction.	
P215: influences the start search direction during find machine zero.	
P29: shifts the actual machine zero in the direction of the clockwise rotating motor.	
P216: sets the limit switch position (must also then be set if there are no configured limit switches (P217=0))	

Example of a reference system definition

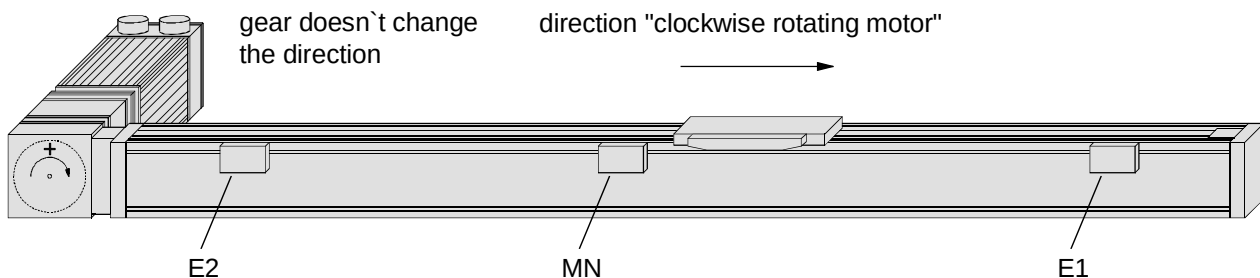
P215="0": the motor rotates clockwise when traveling in the positive direction; i.e. the positive end in the diagram is on the right-hand side.

P212="0": operating mode with reversing initiators; i.e. with 3 initiators.

P217="0": operating mode without end initiators. E1 and E2 act as reversing initiators when performing "Find machine zero".

P216="0": the E1 initiator is driven by the clockwise rotating motor.

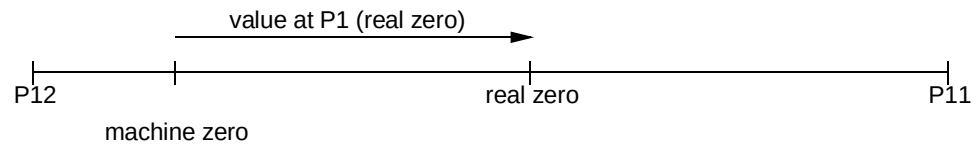
P3 = positive (when P3 = negative, rotates into start search direction)



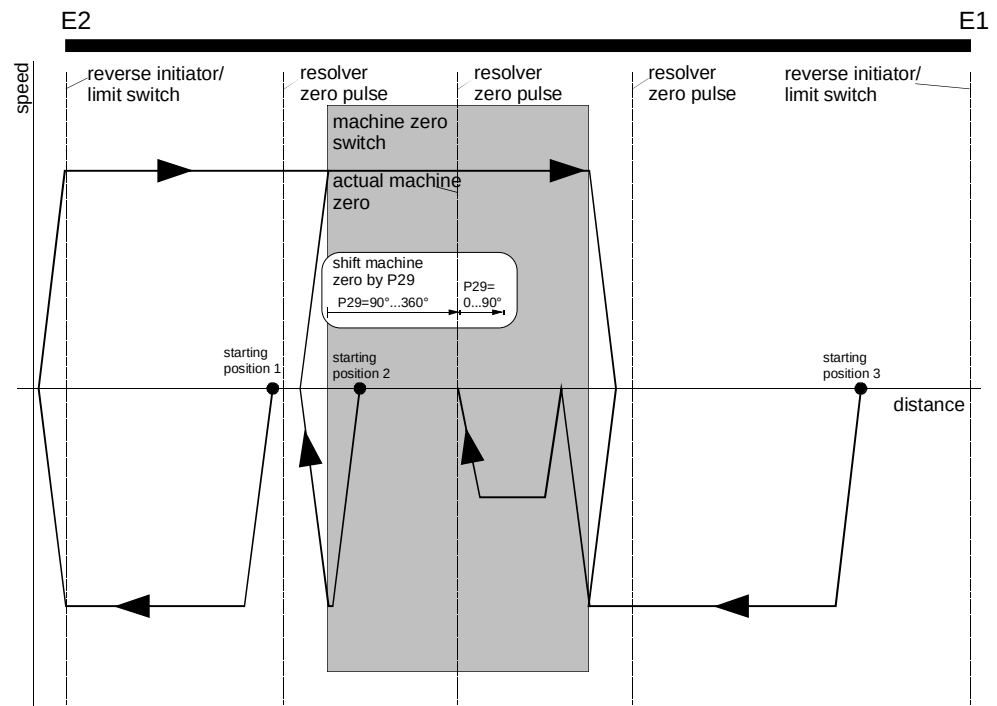
Machine zero mode

Real zero

The position reference for positioning process is real zero; this can be freely defined over the entire displacement area. Real zero is defined with reference to machine zero.



Movement process during find machine zero, depends on start point:



The speed used for find machine zero is established by P3; the accelerating and braking time by P7.

The additional machine zero modes

The machine zero modes described below are all used without reversing initiators. The search direction and the analyzed initiator side are influenced as follows, when working in these machine zero modes:

P213: defines the start search direction and (if there is an initiator fitted) the initiator flank of the machine zero initiator which is being analyzed; i.e. the side from which the initiator is approached

P3: no influence in the start search direction when finding machine zero.

P215: no influence on find machine zero.

P29: shifts the actual machine zero in the direction of the clockwise rotating motor (see below).

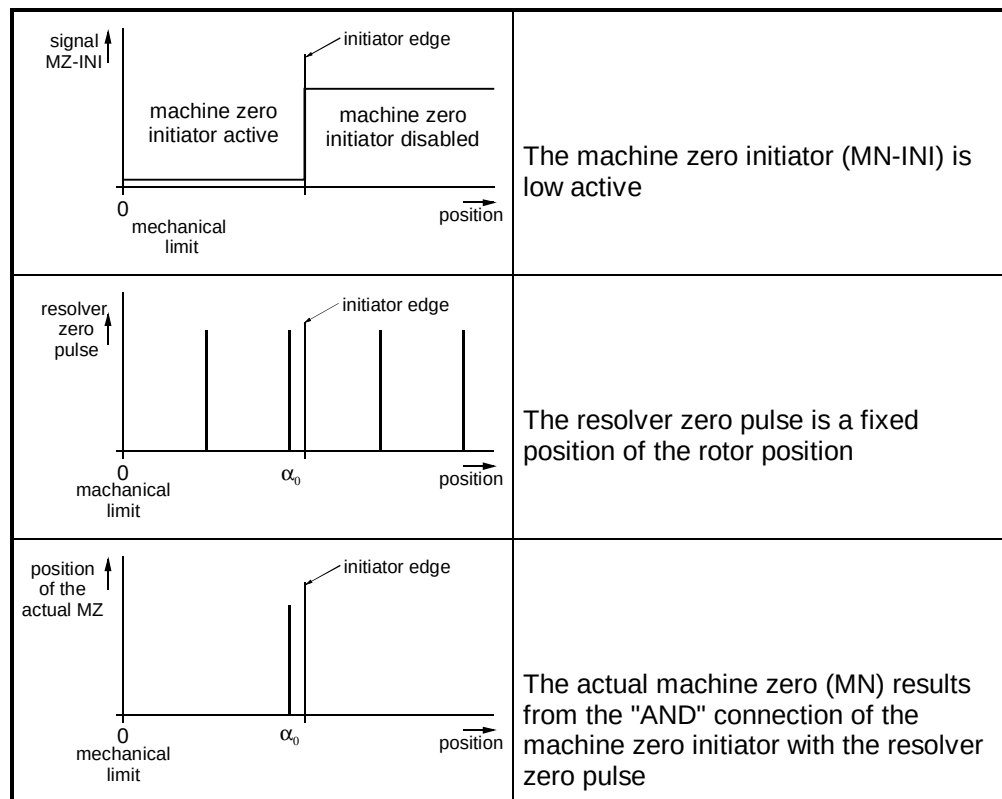
**Machine zero
equal to
external initiator
& resolver zero**

P212="1"

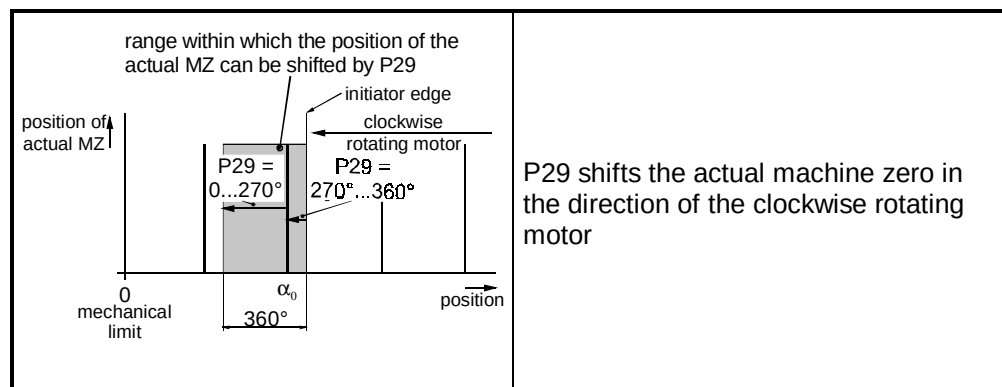
	Find machine zero	Application
P213="0"	clockwise rotating motor signal of MZ initiators resolver zero pulse MN-Ini. actual machine zero P29 = 0° - 270° P29 = 270° - 360°	Standard machine zero mode for linear movements
P213="1"	clockwise rotating motor MN-Ini resolver zero pulse signal of MZ initiators actual machine zero P29 = 100° - 360° P29 = 0° - 100°	

Shifting machine zero

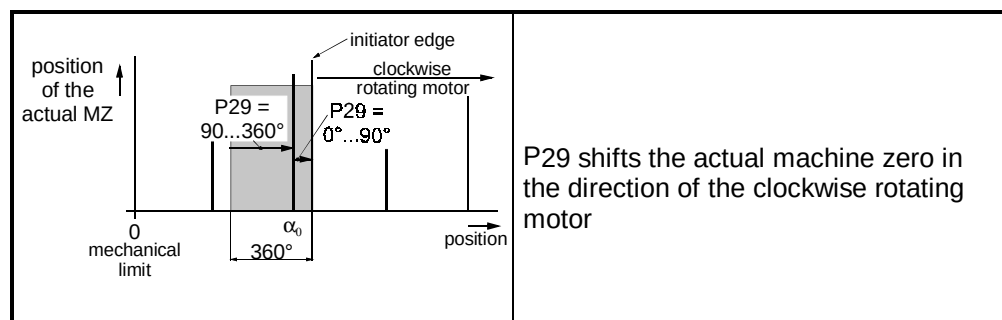
Explanation for shifting machine zero using P29, taking the example of P212="1"



**E.g. 1: $\alpha_0 = 90^\circ$;
clockwise rotating
motor in direction
of mechanical
limitation**



**E.g. 2: $\alpha_0 = 90^\circ$;
clockwise rotating
motor in the
direction of the
mechanical
limitation travel**



Machine zero equal to external zero pulse

P212="3"

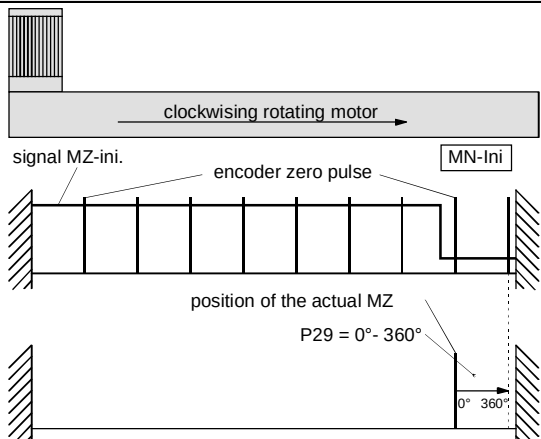
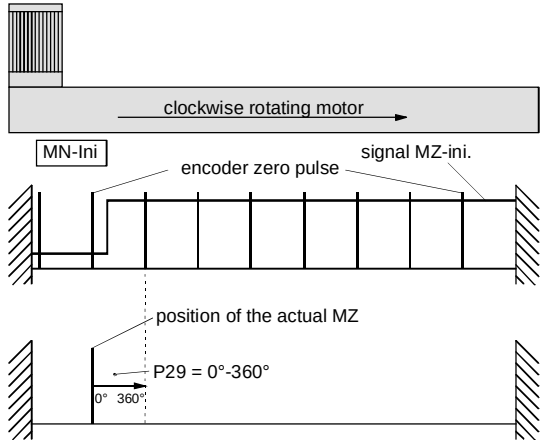
Find machine zero			Application
P213="0"	P29=0°	P29=90°	General rotational movements
P213="1"			

Preconditions for this operating mode:

- ◆ External encoder; read via an encoder input module (E2, E4)
- ◆ Encoder input parameters set using: P144 = "6"
Determine P98 (travel per encoder revolution), P214 (encoder direction) and P143 (encoder pulse number).

Machine zero equal to external initiator & external zero pulse

P212="4"

Find machine zero		Application
P213="0"	 clockwise rotating motor signal MZ-ini. encoder zero pulse MN-Ini position of the actual MZ $P29 = 0^\circ - 360^\circ$	Linear and rotational movements. If you have an encoder on the motor side, with this setting you obtain a reproducible machine zero response to any transmission factor which does not round to whole digits (i.e. not precisely displayable).
P213="1"	 clockwise rotating motor MN-Ini encoder zero pulse signal MZ-ini. position of the actual MZ $P29 = 0^\circ - 360^\circ$	Example of an transmission factor that cannot be displayed exactly: $\frac{17 \text{ teeth}}{11 \text{ teeth}}$
Note! If $P75 \neq 0$ for this setting, external position management is switched on.		

Preconditions for this operating mode:

- ◆ External encoder; read via an encoder input module (E2, E4)
- ◆ Encoder input parameter settings made using: P144 = "6"
Determine P98 (travel per encoder revolution), P214 (encoder direction) and P143 (encoder pulse number).

**Machine zero
equal to
resolver zero**

P212="5"

Find machine zero			Application
P213="0"	P29=0°		General rotational movements. This is a simple way of implementing machine zero, especially if the transmission runs at high speeds.
	P29=90°		
P213="1"	P29=0°		
	P29=90°		

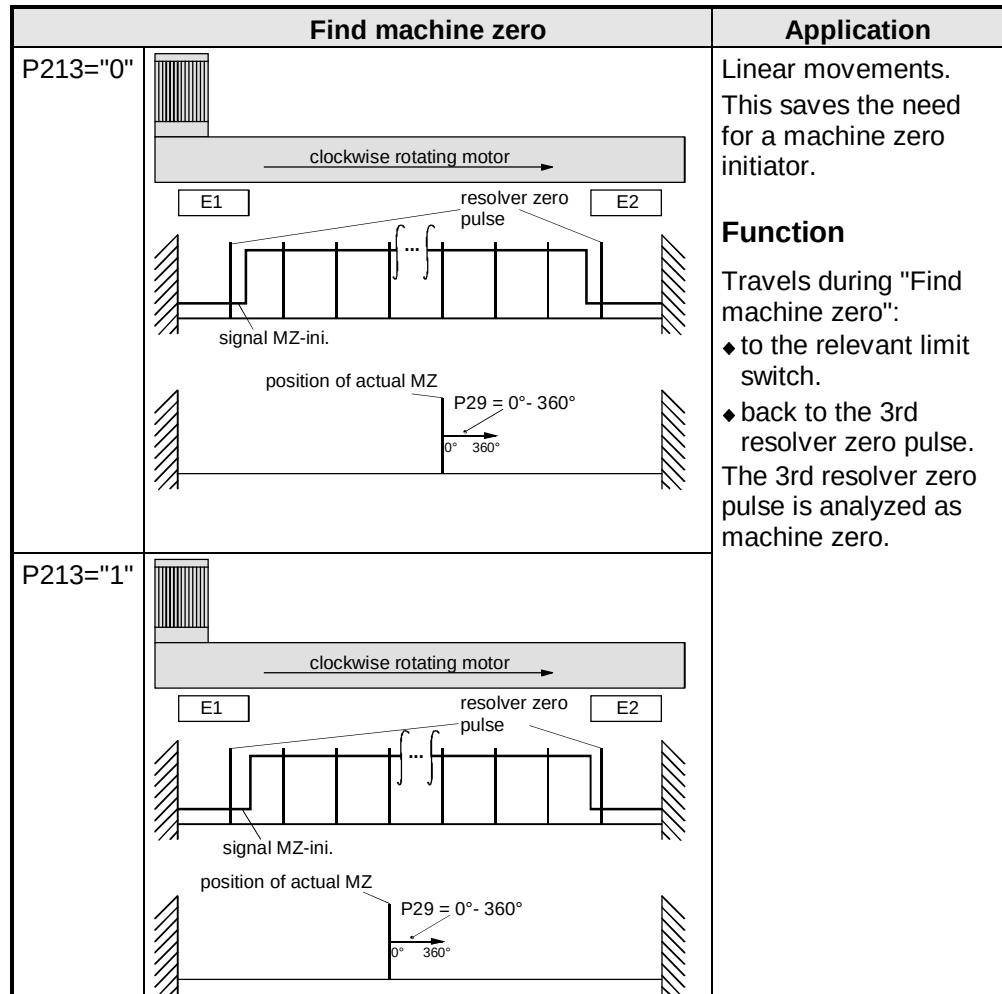
**Machine zero
equal to
external initiator
(without
resolver zero)**

P212="7"

Find machine zero		Application
P213="0"		Linear and rotational movements. If you have an encoder on the motor side, with this setting you obtain a reproducible machine zero response to any transmission factor which does not round to whole digits (i.e. not precisely displayable).
P213="1"		Example of a transmission factor which cannot be displayed exactly: 17 teeth 11 teeth Accuracy: depends on P3. Accuracy in motor revolutions: $= \frac{1\text{ms} \cdot \frac{P3}{100} \cdot P104}{60 \cdot 1000}$

Machine zero equal to a limit switch

P212="8"



Condition:

P217 = "1"

P216 = set correctly.

In the above diagram: P216="1": (limit switch E1 is approached with the anti-clockwise rotating motor)

Wiring up:

The input of the machine zero initiator (X17/7) must be wired up with the relevant limit switch:

P213 = "0": X17/8 must be connected to X17/7.

P213 = "1": X17/9 must be connected to X17/7.

Teaching machine zero (chapter 7.2.5)

P212="10": teaching machine zero

Activated via the "Find machine zero" command (input I1&I2 or "POSA Home" command), the present position of the motor is defined as machine zero.



Using this method, you no longer need to use a machine zero initiator at all.

Via the parameter P29 the machine zero can be adjusted from the redefined point by up to one motor revolution. The drive then executes machine zero travel (starting at the current position) by an angle of P29 in a clockwise direction. Range of values for P29: 0...360 degrees (other values are considered as 0).



If P29=0, machine zero travel is not performed.

7.2.7 Limit switch operation**P217 ="0" operating mode without end initiators****P217 ="1" operating mode with two end initiators**

2 initiators are required.

The displacement area is limited by the initiators attached at both ends of it. When one of the end initiators is activated, an error message appears, the drive is decelerated using P10; this does not apply to the "Find machine zero" function. When P212 = 0 (or = "2"), the initiators are used as reversing initiators during "Find machine zero".

When in other machine zero modes, the initiators can be switched as end initiators by P217 via bit 1.

**Limit switch
monitoring
during the
reference travel**

Bit 1⁶ (P217) = 0: limit switches are not monitored during reference travel.
= 1: (P217= 3) limit switches are monitored during "Find machine zero" (provided that P212<>0 and P212<>2).

The operating mode bit 1(P217)=1 assumes that 3 initiators are connected. Here it is not possible to use one of the two end initiators as a machine zero initiator. Regardless of the search direction P213, both limit switches are monitored.

**Response when the
limit switch is
reached:**

When one of the two limit switches is reached, COMPAX responds with an emergency stop.

Then the following applies: firstly move out of the danger zone using Hand+/-, then acknowledge.

In such instances, the "MN approached" output is not set.

**P216:
determining the
limit switch
position**

Initiator E1 is assigned the direction of motor rotation using P216.

P216: ="0": the initiator E1 is approached using the clockwise rotating motor.

P216: ="1": the initiator E1 is approached using the anti-clockwise rotating motor.



Clockwise rotating is to the right when looking at the motor shaft.

Setting aid:

Proceed to a limit switch using Hand+ (when P215="0"); an error message appears in the COMPAX display:

- ◆ error 50: E1 has been activated; i.e. P216="0"
- ◆ error 51: E2 has been activated; i.e. P216="1"



This allocation only applies if P215="0"; if P215="1" the allocation is reversed.

When operating with the reversing initiators, yet without limit switches, an error message will appear. You then have two options:

- ◆ to set P216, switch on operation with limit switches (P216="1") or
- ◆ in the status value S24, you can view bits 3 and 4 (from the left) to see which initiator is active. Meaning:
 - Bit 3: E2 is activated, i.e. P216="1"
 - Bit 4: E1 is activated, i.e. P216="0"

⁶ Counting in bits beginning with bit 0.

7.3 Configuration via PCs with "ServoManager"



There is a separate manual available which describes how to work with ServoManager.

7.3.1 Installing ServoManager

- | | |
|---------------------|---|
| Preparation | <p>Before installation, deactivate the following programs:</p> <ul style="list-style-type: none"> ◆ any virus detection software. ◆ the Miro Pinboard fitted to Miro graphic cards. <p>Information concerning these programs.
Following installation, the virus software can be reactivated.
Problems can also occur during program execution with the Miro Pinboard.</p> |
| Installation | <p>Start the "Setup.exe" program on disk 1. The installation is a menu-guided process.
Following the installation, a Windows program group will appear containing the ServoManager and the terminal.</p> |

7.3.2 Configuring COMPAX

- ◆ Create connection to COMPAX: cable SSK1 (refer to page 39).
- ◆ Call up ServoManager.
- ◆ Create a new project (Menu: Project: New).
- ◆ Using the menu "Axis: Insert: From controller", a axis is created which contains all the COMPAX settings (all parameters: including system parameters and data records, for COMPAX XX70 curves are also available).
- ◆ Use the menu "Servo-Tools: to switch over to ParameterEditor.
- ◆ Call up menu "Configuration: managed configuration".
All the configuration parameters are queried one after another.

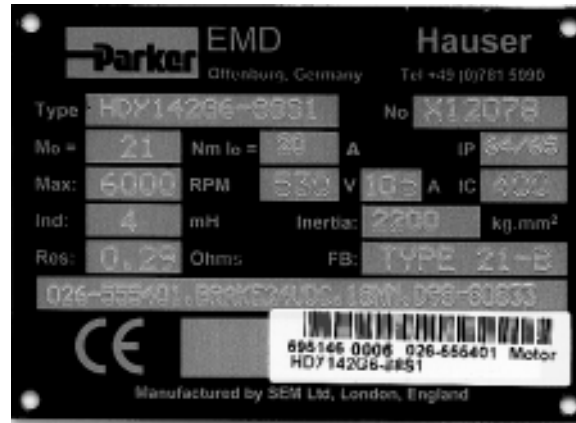
7.3.3 Individual configuration of the synchronous motors

In addition to the motors contained in ServoManager / ParameterEditor, you can configure almost any synchronous motors. The preconditions required of the motors and resolvers are listed in the start-up manual under "Technical data".

To modify the motor parameters, you must switch off the motor (using OUTPUT O0=1 or by pressing the "-" - key on the front plate while switching on COMPAX).

You will find the data required for this on the HAUSER motor type plate.

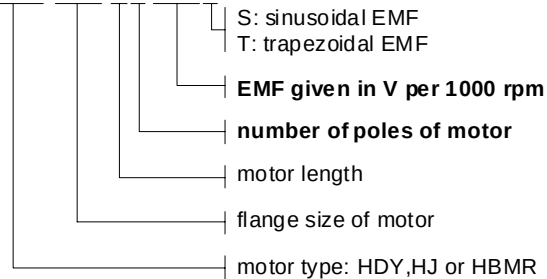
Motor type plate



Proceed as follows:

The following parameters can be read directly from the motor type plate :

- ◆ P101: number of motor terminals
- ◆ P102: EMC [V/1000 rpm]
These two values are contained within the motor type description (type).
HDY xxx Ax-xxxS



- ◆ P103: motor moment of inertia (inertia) [kgmm²]
- ◆ P109: stand inductivity (ind) [μH]
- ◆ P113: maximum mechanical speed (max) [rpm]
- ◆ P116: stand resistance (res) [W]
- ◆ P105: effective value of the nominal current I_N [mA]
HBMR motors: $I_N = 0.95 \cdot I_0$
HDY motors: $I_N = 0.85 \cdot I_0$
HBMR 55 and 70: $I_N = 0.85 \cdot I_0$
- ◆ P106: nominal torque MN
HBMR motors: $M_N = 0.92 \cdot M_0$
HDY motors: $M_N = 0.82 \cdot M_0$
HBMR 55 and 70: $M_N = 0.82 \cdot M_0$
when I_0 = idle current
 M_0 = idle torque

The other parameters are deduced from the type plate data

Nominal motor speed for the HBMR motors

- ◆ P104: nominal motor speed [rpm]

EMC	n_N [rpm]	
	$U_{ZW}=300V$	$U_{ZW}=560V$
32	5000	
44	4000	5000
64	2600	5000
88		3500
130		2400
180		1700
260		1250
360		800

with
EMC: counter EMC
 n_N : nominal speed
 U_{ZW} : intermediate circuit
voltage
300V: with 230V AC
560V: with 3*400V AC

Nominal motor speed for HDY motors:

♦ P104 nominal motor speed [rpm]

EMC	n _N rpm]	
	U _{ZW} =300V	U _{ZW} =560V
32	5000	
44	4400	5000
64	2800	5000
88	2000	3800
130	1400	2500
180		1800

with
 EMC: counter EMC
 n_N: nominal speed
 U_{ZW}: intermediate circuit
 voltage
 300V: with 230V AC
 560V: with 3*400V AC

Parameter for saturation characteristics curve:

♦ P119 start of saturation [%]

♦ P120: end of saturation [%]

♦ P121: minimum stand inductivity [%]

	Flange size	P119	P120	P121
HBMR	<= 115 mm	100	280	40
	>= 142 mm	70	240	40
HDY/ HJ		100	400	100

The saturation is switched of when P119 = P121 = 100% and P120 = 400%.

➡ If you do not know the saturation, use the HDY values.

The additional parameters of the motor table should only be modified under exceptional circumstances.

Standard values of the HBMR and HDY motors:

Parameter	STANDARD	Meaning	Unit
P107	300	Pulse current	%
P108	3000	Pulse current time	ms
P129	0	Resolver offset	Degree
P130	"2" (P1:"1") ⁷	Resolver frequency	
P131	"2" (P1:"1")	Resolver amplification	
P132	"2"	Position sensor	
P133	65 536	Sensor dash count	Increments

Holding brake

For motors with holding brake.

Calculate the braking delay in P17 (for more information refer to page95).

Meaning:

Motor	Shift times when closing the brake
HDY55...	20 ms
HDY70...	10 ms (24 ms with amplified brake)
HDY92...	20 ms
HDY115...	20 ms
HDY142...	40 ms
HBMR190...	40 ms

⁷ You will find the following on the HAUSER motor type plate:

FEEDBACK 21-B; FEEDBACK 15-B: P4 ⇒ P130=P131="2"

FEEDBACK 21-A; FEEDBACK SSBH-21-k1: P1 ⇒ P130=P131="1"

Drive type

If you firstly want to operate the motor without the mechanics, then select:

- P80=16: general drive.
- P81=P82=moment of inertia of the motor.
- P93=2: continuous mode.
- ◆ Call up the "Parameter: managed parameter setting" menu.
The remaining parameters are queried one after the other.
- ◆ Use menu "Online: Download" to transfer the data into COMPAX and to validate.

**Caution**

**Secure the displacement area of your system or the motor.
When switching on, there is a risk as you may have incorrect configuration data.**

**Safety
instructions for
the first start-up**
Risk of incorrect wiring!

In order to avoid the risk of wiring the system incorrectly when first starting up, you should use the following settings for your own safety and for the protection of your system:

P15 = 10% (motor speed limited to 10% of its nominal value)

P16 = 100% (torque limited to 100% of its nominal value)

- The drive must remain on after the system has been switched on.
 - Start to operate the system, either with POSR x or manually +/-.
- If this travel motion is performed correctly, you can reset P15 and P16 to their original values.

The following errors may occur

- The drive may remain at a standstill once switched on or
- the drive runs out of control when the start command is given.

In both instances, either error E10 or error E54 is triggered.

If error E54 occurs, the drive is switched off.

A possible cause of the error is incorrect wiring in the motor of resolver systems.

- The servo controller will start to operate once you have acknowledged error E55 on the front plate using "Enter".
- If the controller is set to "OFF", it will be brought into operation by switching the 24V control voltage off and then on.
- ◆ You can now use menu "Online: Command" to transmit commands to COMPAX (e.g. POSR 100 and the motor travels 100 units in the positive direction).



COMPAX is now configured.

If you want more information, please either use the table of contents or the glossary at the end of the User Guide.

POSA

POSR

SPEED

ACCEL

OUTPUT

Password

SPEED

SYNC

Mark
reference

POSR

SPEED

POSROUTP

UT

WAIT

GOTO

GOSUB

RETURN

END

REPEAT

IF E..

Comparison

WAIT Start

GOTO /

GOSUB EXT

IF Error/ Stop

Arithmetic

Position
monitoring

Idle display

Speed
monitoringEngaging /
disengaged
brake / final
stageVariable
voltage

7.4 Positioning and control functions

7.4.1 Command / program instructions

The COMPAX basic unit is totally oriented towards the technical control requirements of a servo axis. Special control commands are implemented in the different unit variants for synchronizer or transmission functions. The support of a superordinate control unit is required for more complex systems, especially for the co-ordination of several axes. Parker supplies solutions based on PCs or programmable controllers (SPS) for such cases, as well as the compact industrial computer COMTAC as a multi-axis simultaneous control unit.

Up to 250 sequentially numbered sets of commands can be stored in the COMPAX program memory. The program procedure can be controlled using data interfaces or binary I/Os. It is possible to select addresses (data record selection) using the interpretation of the adjoining binary input signals (external data record selection).

The sets of commands have been deliberately kept simple and resemble the well-known programming language, Basic. Program control instructions, comparator functions, setting / resetting outputs and the motion-related commands for specifying velocity, position, acceleration time etc. are also possible.

Sample program:

N001: ACCEL 250	acceleration time 250 ms
N002: SPEED 80	velocity 80%
N003: REPEAT 10	specified wait loop 1s
N004: IF I7=1 GOTO 9	query I7 to log. 1
N005: WAIT 100	waiting time 100 ms
N006: END	end of REPEAT loop
N007: OUTPUT O7=1	sets output; no positioning
N008: GOTO 13	
N009: POSA 1250	positioning
N010: OUTPUT O8=1	sets O8 for 500 ms
N011: WAIT 500	
N012: OUTPUT O8=0	
N013: END	

The range of commands used with the compact COMPAX servo control unit is deliberately different to the range used in standard NC programming norms as described in DIN 66024 and DIN 66025. The commands differ in terms of type and range. COMPAX is not designed with the control and calculation output of a complete CNC, even though it realizes many of the CNC functions.

All commands are processed in sequence (sequential step programming). The program can be interrupted or suspended using a break or stop signal. The axis is then decelerated using the preset time delay. The program can then be continued at another point.

Starting program

Once "Power on" is in place, the data record indicator is at 1. If the program is to started at another point, the data record indicator can be adjusted using the command "GOTO xxx" (The direct command is only recognized by COMPAX if O4 "Ready for start" ="1").

Using the "START" command (via the digital input I5 or using the direct "START" command via an interface), you can start the program as of the selected data record number.



The data record indicator is set to 001 using the "Find machine zero" or "Approach real zero".

This function can be set to binary inputs using parameter P211.

POSA**7.4.1.1 Absolute positioning [POSA]****Reference point is real zero (RZ).**

Positioning is performed using the acceleration speed set using ACCEL and the velocity set using SPEED. If these values have not previously been set, substitute values will apply:

SPEED: Parameter P2; ACCEL: Parameter P6 (refer to page 165)

Syntax: POSA value

Value: figure with two digits after the decimal point (three in the case of inches) in the unit defined in P90; a control parameter (P40..P49) or a variable (V1..V39)

e.g. POSA .P40

The range is defined by the software end limits P11 and P12.

Example: N005: POSA 150.50 Absolute positioning to +150.5 units
N006: POSA -500 Absolute positioning to -500 units

Additional function: A position approached manually can be transferred as a POSA command into a previously selected data record using "TEACH data record" (via an interface).



When in continuous mode, relative positioning is also adopted with POSA.

POSR**7.4.1.2 Relative positioning [POSR]****The present position is the point of reference.****Syntax: POSR value**

Value: two digits after the decimal point (three in the case of inches) in the unit defined in P90; a control parameter (P40..P49) or a variable (V1..V39)

e.g. POSR .P40

The range is defined by the software end limits P11 and P12.

Example: N005: POSR 2000 Relative positioning by +2000
N006: POSR-100.25 Relative positioning by -100.25



The positioning commands POSR and POSA can be controlled using binary input I15 "Fast start". This function is switched on using P18. COMPAX then waits until I15="1" before it performs POSR or POSA (refer to p. 115).

POSA
 POSR
SPEED
ACCEL
OUTPUT
Password
 SPEED
 SYNC
 Mark
 reference
 POSR
 SPEED
 POSROUTP
 UT
 WAIT
 GOTO
 GOSUB
 RETURN
 END
 REPEAT
 IF E..
 Compare
 WAIT Start
 GOTO /
 GOSUB EXT
 IF Error/ Stop
 Arithmetic
 Position
 monitoring
 Idle display
 Speed
 monitoring
 Engaging /
 disengaging
 brake / final
 stage
 Variable
 voltage

SPEED

7.4.1.3 Process velocity [SPEED]

Process velocity as % of nominal velocity

(Nominal velocity $\equiv$ nominal speed * travel per motor rotation).

♦ valid until a new value is programmed.

When in **speed control mode**, direction of rotation is specified by the prefix.

Syntax: **SPEED value**

Value: 0.0000001...100%⁸, a control parameter (P40..P49) or a variable (V1..V39)
e.g. SPEED .P40

Example: N005: SPEED 70 sets velocity to 70% of nominal speed.

➡ The set velocity can be reduced using the analogue override input (X11.6)
(refer to starting up manual).

ACCEL ACCEL-

7.4.1.4 Acceleration and braking time [ACCEL]

Specification for acceleration and braking time .

♦ without prefix: time specification for acceleration and deceleration process.

♦ negative prefix: separate time specification for deceleration process.

♦ Valid until a new value is programmed.

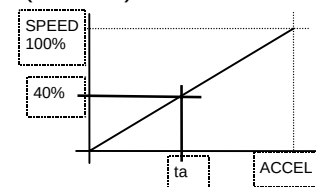
♦ Acceleration process can be specified using parameter P94 (refer to page 53).

Syntax: **ACCEL value**

Value: 10...65 000 ms a control parameter (P40..P49) or a variable (V1..V39) e.g.
ACCEL .P40 (timescale = 10 ms)

The negative prefix for the deceleration time specification must be set
before the control parameters e.g.: ACCEL- .P40 (P40 > 0)

➡ The time is specified in ms and applies for nominal
velocity (100%). The actual time is proportional to the
velocity selected. Meaning: $t_a = \frac{\text{SPEED}}{100\%} \text{ ACCEL}$



Example: N005: ACCEL 300 sets the acceleration and deceleration ramp to 300 ms
N006: ACCEL -200 sets the deceleration ramp to 200 ($\equiv$ 200 ms when
SPEED=100%)

OUTPUT

7.4.1.5 Setting/resetting an output [OUTPUT]

Syntax: **OUTPUT output = 1/0**

Output: O1⁹...O16

Example: N005: OUTPUT O8=1 Sets output 8
N005: OUTPUT O8=0 Resets output 8

⁸ For asynchronous motors, up to a max. of 300%.

⁹ A1...A6 only if masked via P225.

**OUTPUT
O12=1010****7.4.1.6 Setting multiple digital outputs [OUTPUT O12=1010]**

Multiple outputs can be set simultaneously.

Syntax: OUTPUT O12=1010
 OUTPUT O10=01--011 ("-"¹⁰ = is not modified)
 O10="0"; O11="1"; O12, O13 are not modified; O14="0"; O15=O16="1".
 (this is valid for max. 8 outputs)

Note:

- ◆ A maximum of 8 outputs can be processed per OUTPUT command.
- ◆ The comparator command "POSR OUTPUT" is still limited to setting one output.

OUTPUT O0**7.4.1.7 Switching off drive unit. [OUTPUT O0]**

Syntax: OUTPUT O0 = *number*
Number: 0/3: driver is subject to torque when brake is open.
 1: Drive is switched off when brake is closed.
 2: Drive is switched off when brake is open.

Example: OUTPUT O0=1 Drive is switched off when brake closed.

7.4.1.8 OUTPUT O0=... in program

Limitation: The command OUTPUT O0=0,1,2 can only be programmed **on the COMPAX XX00 and COMPAX XX60** in the program.
 No error monitoring is performed when in switched off status. Emergency stops are the one exception to this (E55/E56).
 This means that all errors which can be acknowledged (e.g. lag errors or resolver errors), which first arise during the switched off status (e.g. by separating the resolver line) are ignored.
 Only errors which are still present after Power On are displayed.

GOTO**7.4.1.9 Password [GOTO]**

Syntax: GOTO *number*
Number ="302": Deactivates password protection
 ="270": Activates password protection
Note: You can also use this command in the natural language memory.

Example: GOTO 302 Approves programming levels and parameters.

¹⁰ Rather than "-", "." is also an option

POSA

POSR

SPEED

ACCEL

OUTPUT

Password

SPEED

SYNC

Mark

reference

POSR

SPEED

POROUTP

UT

WAIT

GOTO

GOSUB

RETURN

END

REPEAT

IF E..

Comparison

WAIT Start

GOTO /

GOSUB EXT

IF Error/ Stop

Arithmetic

Position

monitoring

Idle display

Speed

monitoring

Engaging /

disengaging

brake / final

stage

Variable

voltage

SPEED SYNC

7.4.1.10 External velocity specification. [SPEED SYNC]

Entry at BDF2: SPEED Ent

COMPAX synchronizes itself to an external velocity specification.

Attention: function only applies to COMPAX XX00 with options E2 or E4!
SPEED SYNC cannot be used at the same as the external position adjustment (switched on via P75 ≠ 0)!

Instead of specifying velocity using the SPEED command, when you use SPEED SYNC, the process command velocity is read externally from the encoder interface.

Condition for setting: P144="4" and P188="0"

Setting aid: the speed of the motor and sensor can be made the same using P98=P83 and the correctly set parameter P143 (pulse speed sensor).

◆ No travel synchronization; for this function, use our "Electronic transmission" or "Electronical curve control" unit variant.

POSR

7.4.1.11 Mark-related positioning [POSR]

You can use this command to perform positioning e.g. a mark to an external signal.

Syntax: POSR *value*

Value: two digits after the decimal point (three in the case of inches) in unit corresp. to P90; a control parameter (P40..P49) or a variable (V1..V39) e.g. POSR .P40.

The prefix determines the direction in which the mark is approached.

Note!

POSR 0 is not permitted!

Attention:



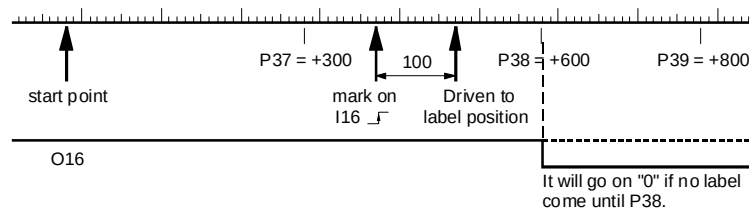
When the mark reference is activated, you must not use the POSA command!

I14:	Activating mark reference . I14 must be present in front of the command.
I16:	Mark input The increasing flank is analyzed.
O16:	With "0", the mark is missing from the point where travel is completed and (P38) is reached.
P35:	= "1": Mark reference switched on; = "0": Mark reference switched off.
P37,P38:	A mark window is determined relative to the start position using P37 and P38.
P37:	Minimum travel to mark. (relative to start position).
	Range of values for P37: 0.00 ... P38
P38:	Maximum travel to mark. (relative to start position).
	Range of values for P38: P37 ... 4 000 000
P39:	Maximum feed length, if there are no marks in the mark window (relative to start position).
	Range of values for P39: P38 ... P11 or P12

Example:

POSR 100 P35="1"; P37=+300; P38=+600; P39=+800; I14="1".

If the mark is between +300 and +600, in keeping with mark +100, it will be outwith of the window and so is positioned to 800.



Note!

The drive positioning is not limited by P39.

If the mark is within the mark window, COMPAX performs positioning using POSR *value* for a *value* of the corresponding size, even behind P39.

The process range can be limited using P11 and P12.



When the mark reference is switched on, the inputs I14, I15, and I16 are no longer available for external data record selection (GOTOEXT, GOSUBEXT).

POSA
 POSR
 SPEED
 ACCEL
 OUTPUT
 Password
 SPEED
 SYNC
 Mark
 reference
POSR
SPEED
 POSR
 OUTPUT
 WAIT
 GOTO
 GOSUB
 RETURN
 END
 REPEAT
 IF E..
 Comparison
 WAIT Start
 GOTO /
 GOSUB EXT
 IF Error/ Stop
 Arithmetic
 Position
 monitoring
 Idle display
 Speed
 monitoring
 Engaging /
 disengaging
 brake / final
 stage
 Variable
 voltage

7.4.1.12 Preparatory instructions

The following command combinations are preparatory instructions whose purpose is to create speed step profiles or to set comparator switch points. The prepared positioning process is started using POSA or POSR. Note the following:

- ◆ Combined commands can be mixed (POSR SPEED, POSR OUTPUT).
- ◆ A total of 8 combined commands can be programmed per positioning process.
- ◆ The positioning values of the command combinations are always positive and refer to the start point of the positioning process. They represent differences in travel. The direction is specified by the next positioning command. This can be relative (POSR) or absolute (POSA). Meaning:
 - ◆ The positioning values for speed steps, ramp times or comparators always apply as of the point at which positioning starts (for POSA and for POSR)
 - ◆ The positioning values for speed steps, ramp times or comparators are numerical amounts:
 - ◆ If the following positioning is positive, then COMPAX calculates them as positive values.
 - ◆ If the following positioning is negative, then COMPAX calculates them as negative values.
- ◆ If a process cycle has been interrupted by "Stop" you can continue and complete this cycle using "Start".
- ◆ The preparatory instructions are canceled by the "Hand+/-", "Find machine zero" and "Approach real zero" commands.

POSR SPEED

7.4.1.13 Changes in speed within a positioning process [POSR SPEED]

Each speed step profile can have a maximum of 8 speed steps. The comparator value is specified as a relative dimension. It is referenced to the positioning start point.

Syntax:

POSR *value 1* SPEED *value 2*

Value 1: only positive values are permitted (unit corresponds to P90); two digits after the decimal point (three in the case of inches), a control parameter (P40..P49) or a variable V1 ... V39.

Value 2: no digits after the decimal point; numerical value, a control parameter (P40..P49) or a variable V1 ... V39.
e.g.: POSR .P40 SPEED .P41

Example:

N001: ACCEL 250	Acceleration and braking time = 250 ms
N002: SPEED 20	Starting velocity = 20%
N003: POSR 150 SPEED 30	1st speed step when starting position ± 150 , sets velocity to 30%.
N004: POSR 300 SPEED 50	2nd speed step when start position ± 300 , sets velocity to 50%.
N005: POSR 500 SPEED 80	3rd speed step when start position ± 500 , sets velocity to 80%.
N006: POSR 900 SPEED 60	4th speed step when start position ± 900 , sets velocity to 60%.
N007: POSA -1000	Positioning command to position -1000 (position -1000 is approached with all of or one part of the speed step profile, depending on the start point).
N008: POSR 200 SPEED 50	Prepares a new speed step profile.
N009: ...	

Speed step profile extended by ramp time

Compatibility: Speed step profiling is still possible in the previous version with no restrictions.

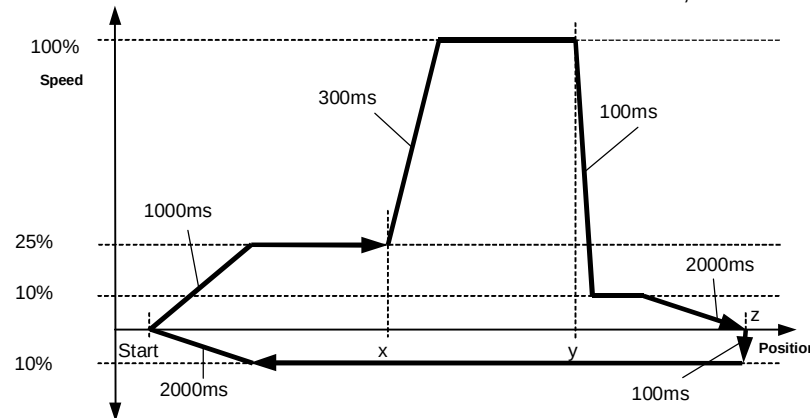
- Function:**
- ◆ In addition to the new velocity, the acceleration time can be defined for the speed step profile.
This becomes effective at the transition to the defined velocity, and remains valid until a new acceleration time is defined.
 - ◆ The braking time is assigned within the speed step profile, however not using ACCEL-, but rather is defined by the velocity change.
 - ◆ The deceleration ramp for the target position is defined by the previously set ramp (braking time in effect before the speed step profile).

POSR x SPEED y Abbreviation: PR x SD y AL z
ACCEL z x, y, z: number, parameter .P40 (P40-P49) or variable .V1 (V1-V39)

Example: PR .P40 SD .V31 AL 200

- Note:**
- ◆ The last ramp time selected using a prepared command from ACCEL remains valid for future positioning processes.
 - ◆ The situation with SPEED is same.
 - ◆ A braking time previously defined with ACCEL- remains unaffected.

Example: ACCEL 1000 Generally valid acceleration time
 ACCEL -2000 Generally valid braking time
 SPEED 25 Generally valid velocity
 POSR x SPEED 100 ACCEL 300 1st speed step at position x
 POSR y SPEED 10 ACCEL 100 2nd speed step at position y
 POSA z Start positioning to z
 POSA 0 Return with SD 10, AL100 and AL-2000



1. Position x is approached with 25% velocity and 1000 ms acceleration time.
2. Position y is approached with 100% velocity and 300 ms acceleration time.
3. Position z is approached with 10% velocity and 100 ms acceleration time.
4. To move to position z, deceleration is performed in good time using a braking ramp of 2000 ms.
5. After the command POSA 0, the drive returns to the starting point (= position 0). The drive accelerates for the last set 100 ms to the last set velocity of 10% and returns to position 0. The braking time of 2000 ms, which was set before the speed step profile, is used as the braking ramp.

POSR OUTPUT

7.4.1.14 Comparators during positioning [POSR OUTPUT]

Setting and resetting freely assignable outputs within a positioning process.

A maximum of 8 comparators can be set in one positioning process. The comparator value is specified as a relative dimension. It is referenced to the positioning start point.

Syntax: POSR *value* OUTPUT *output* = 1/0

Value: only positives value are permitted (unit corresponds to P90); two digits after the decimal points (three in the case on inches) a control parameter (P40..P49) or a variable (V1..V39)
e.g. POSR .P40 OUTPUT O7=1.

Examples:	N001: ACCEL 250	Acceleration and braking time = 250 ms
	N002: SPEED 50	Initial velocity =50%
	N003: POSR 150 OUTPUT O8=1	1st comparator at start position 150, sets output O8 to 1.
	N004: POSR 300 OUTPUT O7=1	2nd comparator at start position 300, sets output O7 to 1.
	N005: POSR 500 OUTPUT O7=0	3rd comparator at start position 500, sets output O7 to 0.
	N006: POSR 900 OUTPUT O8=0	4th comparator at start position ±900, sets output O8 to 0.
	N007: POSA 1000	Positioning command to 1000 (Position +1000 is approached; the travel-dependent comparators are set once the relative positions have been reached).
	N008: POSR 200 OUTPUT O7=1	Prepares new comparators.



Outputs O1 to O6 can also be used as comparators once approval is given via P225 (refer to page 108).

Diagram of specified example for POSR OUTPUT

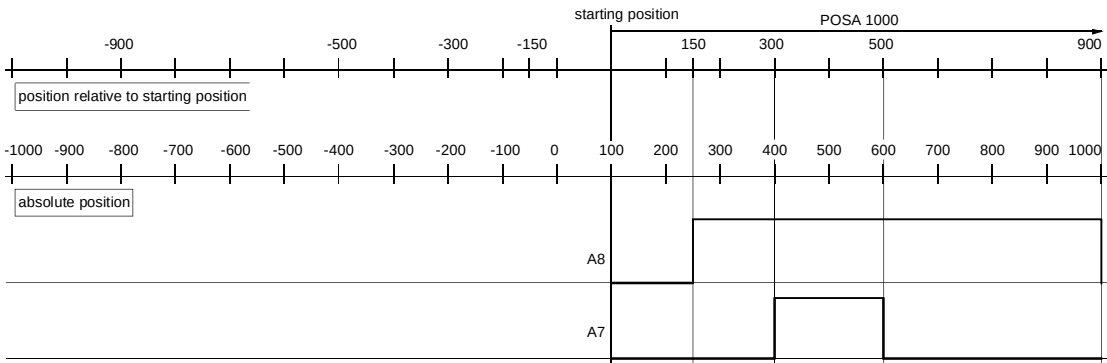
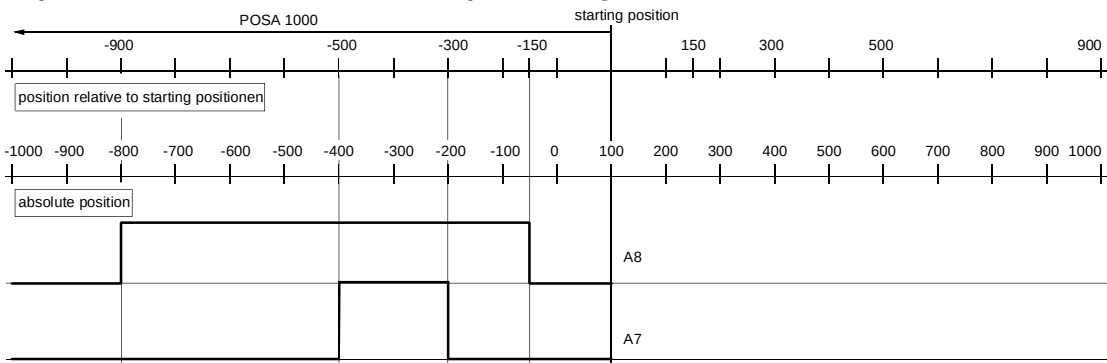


Diagram of example, however with POSA -1000 as positioning



7.4.2 Controlling programming procedure

WAIT

7.4.2.1 Programmable waiting time [WAIT]

Programmable waiting time in ms before the next data record is processed.

Syntax: WAIT *value* *Value:* 10...65 000 [ms] a control parameter (P40..P49) or a variable (V1..V39)
e.g. WAIT .P40 (timescale 10 ms)

Example: N005: WAIT 500 Sets the waiting time to 500 ms before the next data record is processed.

GOTO

7.4.2.2 Program jump [GOTO]

Program jump to specified data record number.

Syntax: GOTO *data record number*
Data record number: 1 ... 250

Example: N045: GOTO 60 Jumps to data record N060

GOSUB

7.4.2.3 Sub-program jump [GOSUB]

Jump into a sub-program .

Syntax: GOSUB *data record number*
Data record number: 1 ... 250

Example: N005: GOSUB 100 Calls up sub-program
N100: ... Starts sub-program
N101: ...
...
Nxxx: RETURN Ends sub-program, jumps back to N006

Attention:  Never use GOTO to jump out of a sub-program or into a sub-program.

RETURN

7.4.2.4 Instruction to end a sub-program. [RETURN]

This actions a return jump to the main program.

Syntax: RETURN

POSA

POSR

SPEED

ACCEL

OUTPUT

Password

SPEED

SYNC

Mark
reference

POSR

SPEED

POSR

OUTPUT

WAIT

GOTO

GOSUB

RETURN

END

REPEAT

IF E..

Comparison

WAIT Start

GOTO /

GOSUB EXT

IF Error/ Stop

Arithmetic

Position
monitoring

Idle display

Speed
monitoring

Engaging /
disengaging
brake / final
stage

Variable
voltage

END

Syntax:

7.4.2.5 END instruction [END]

END instruction for a REPEAT loop or for the program.

To end a program, you activate a program stop. The data record indicator is not modified.

END

REPEAT

Syntax:

REPEAT Value

Value: 1...65 000 a control parameter (P40..P49) or a variable (V1..V39)
e.g. REPEAT .P40

Example:

N005: REPEAT 10 Starts a program loop, which is run through 10 times

N006: ...

N007: END End of loop

➡ A loop can be prematurely exited using GOTO.

7.4.2.6 Start a program loop [REPEAT]

The following program sequence is run through the number of times specified in *value* until an End instruction appears.

IF I7=1

Syntax:

IF control input=1/0 GOTO/GOSUB data record number

Control input: I1¹¹...I16

Examples:

IF I7=1 GOTO 010

If I7 = "1", a jump is made to data record N010

IF I7=1 GOSUB 010

If I7 = "1", a jump is made to the sub-program in data record N010

7.4.2.7 Branching related to a control input [IF I7=1]

IF I12=101-1

Syntax:

IF I12=101-1 GOTO 123

-> I12 = 1, I13=0, I14=1, I15= "not taken into consideration", I16 = 1.

Binary IF querying of status values or outputs is not possible.

A maximum of 8 inputs can be queried per IF instruction.

7.4.2.8 Binary IF query of inputs [IF I12=101-1]

Multiple inputs can be queried simultaneously.

The inputs are compared with a mask. The mask contains individual bits 1 or 0, and a space marker (-)¹² for "not taken into consideration".

¹¹ E1...E6 only if masked via P221.

¹² Rather than "-", "." is also possible

7.4.2.9 Comparative operations

Syntax: IF <single Operand> <compare> <Operand> GOTO xxx
or
IF <single Operand> <compare> <Operand> GOSUB xxx

Simple Operand:

- a parameter Pxxx or
- a variable ¹³ Vxxx or
- a status value Sxxx (S1-S15, S30, S40ff)

Operand:

- A simple Operand or
- A constant with max. 8 significant digits

Comparison:

- < smaller
- > larger
- = equals
- <> not equal
- <= equal to or less than
- >= equal to or greater than

Depending on the result of the comparison, a GOTO or GOSUB is carried out.

Examples: IF P40>100 GOTO 234
IF V030<>P49 GOTO 123

Limitation: Within the IF query, no operations with logical operators (AND, OR) are possible.

Writing convention of variables (V0-V39) and control parameters (P40-P49)

For reasons of compatibility, a preceding point (full stop) is expected in the syntax for motion commands:
e.g.: POSA .P40, ACCEL .V10

The new comparison and arithmetic commands will operate without a preceding point (full stop): e.g.:
P41=V10+S1, IF V20 > S2 GOTO 10

WAIT START**7.4.2.10 Focused processing of data record groups. [WAIT START]****Entry at BDF2¹⁴: WAIT Ent**

When this instruction is issued, COMPAX interrupts the programming procedure, until a external START (I5 or via interface) is issued (reaction time <30 ms). For shorter reaction times, refer to I15 on page 115.

Syntax: WAIT START

¹³ for variables, see page 86.

¹⁴ Applies to the manual terminal BDF2/01

POSA
 POSR
 SPEED
 ACCEL
 OUTPUT
 Password
 SPEED
 SYNC
 Mark
 reference
 POSR
 SPEED
 POSROUTP
 UT
 WAIT
 GOTO
 GOSUB
 RETURN
 END
 REPEAT
 IF E..
 Comparison
 WAIT Start
GOTO /
GOSUB EXT
IF Error/
Stop
 Arithmetic
 Position
 monitoring
 Idle display
 Speed
 monitoring
 Engaging /
 disengaging
 brake / final
 stage
 Variable
 voltage

GOTO EXT

7.4.2.11 Jump with data record selection [GOTO EXT]

Jump with data record selection via the inputs I9 to I16.

Entry at BDF2: GOTO Ent

Data record selection as for GOSUB EXT (see below).

GOSUB EXT

7.4.2.12 Sub-program jump with data record selection [GOSUB EXT]

Entry at BDF2: GOSUB Ent

Jump into a sub-program with data record selection via the inputs I9 to I16

The bit pattern of inputs I9 to I16 is interpreted as a data record number (binary).

$$I_{16} \dots I_9 \Rightarrow 2^7 \dots 2^0$$
 e.g. 00 010 100 = 20 $\Rightarrow$ jumps into sub-program at data record 20.



Note!

If inputs have been assigned functions (e.g. fast start I15 or external position adjustment I11), they are not taken into consideration when using GOSUB EXT (read logically as "0"):



The assignments of each the binary inputs I16...I9 must be taken into consideration for the individual unit variants (COMPAX XX50M,...).

When the SPS data interface is activated, the commands GOTO EXT and GOSUB EXT are blocked!

IF ERROR GOSUB

7.4.2.13 Error handling [IF ERROR GOSUB]

For influencing the error reactions.

Syntax:

IF ERROR GOSUB xxx

This instruction can only be programmed as normal IF instructions in the program. You use this instruction to define the procedure taken in the program when an error status arises.

Note!

The error sub-program is called up and delayed using P17 (brake delay). When performing a WAIT START, COMPAX does not branch into the error sub-program when an error arises!

Function:

Normally an error in the COMPAX will cause an actively running move to be broken off. Depending on the type of error, the drive is switched off. The program is however stopped no matter what the error type.

The instruction 'IF ERROR GOSUB xxx' allows you to e.g. set the outputs to defined status's when an error occurs.

If such an instruction has been run once in the program and then an error later arises, the following occurs

- ◆ the current move is broken off,
- ◆ if necessary, the axis is (depending on the error) switched off and
- ◆ finally the 'Error program' which you have programmed as of program number xxx is run.

Priority: The error program has priority over the stop program.
A running stop program is interrupted by the error program and continued after the error program has run.

Error program: The error program must not contain

- ◆ any motion commands (POSA, POSR, POSR ..., WAIT POSA, WAIT POSR, SPEED in the speed control mode,),
- ◆ any sub-program jumps (GOSUB, IF ... GOSUB, ...),
- ◆ any COMPAX XX70 commands,
- ◆ or any approach real zero and find machine zero commands,
- ◆ or contain any speed step commands (POSR ... SPEED ...) and
- ◆ comparator commands (POSR ... OUTPUT ...)

and is used to bring the individual outputs (e.g. the control output for a pump or a valve) into a safe status.

Error program with WAIT START Each error program must contain a 'WAIT START' instruction.
The 'WAIT START' instruction causes the programming procedure to stop before an external QUIT and START may occur.
Then OUTPUT instructions can again be present for resetting the outputs.
There must be a RETURN instruction or an END instruction at the end of the error program.

- ◆ The END instruction stops the program.
- ◆ The RETURN instruction performs a jump back into the program line which was previously interrupted. If necessary, an interrupted movement is continued (provided that the error has been acknowledged in the meantime).

Example:	Main Program	Error Program
	N001: IF ERROR GOSUB 200	N200: OUTPUT O9=0
	N002: OUTPUT O9=1	N201: WAIT START
	N003: POSA 0	N202: OUTPUT O9=1
	N004: POSA 4000	N203: RETURN
	N005: OUTPUT O9=0	
	N006: GOTO 002	

If the axis is now stopped and switched off, e.g. during the POSA 4000 positioning, and this is caused by an error, a sub-program jump is then performed to program line 200 and output O9 is set to zero at this point.
The program then stops in program line 201 and waits until the error has been acknowledged and, if necessary, a new start is made.
At program line 202, output O9 is switched on again, at program line 203, a jump is made back to the previously interrupted program line N004.
The axis performs the rest of the travel to position 4000, and the main program is then continued at program line N005.
If the error program is concluded with END rather than RETURN, the program indicator remains in the same position. The program stops running at this point.
Machine zero e.g. then has to approached or the program indicator must be reset explicitly.

**IF STOP
GOSUB xxx**

7.4.2.14 STOP / BREAK handling [IF STOP GOSUB xxx]

For influencing the behavior after a STOP or BREAK.

Syntax: **IF STOP GOSUB xxx**
This instruction, like normal IF instructions, can only be programmed in the program. It controls the procedure performed in the program when a stop status rises.

Controlling programming procedure

Normally a STOP / BREAK command in the COMPAX will cause a actively running move to be broken off; the program is stopped.
The instruction 'IF STOP GOSUB xxx' allows you to set the outputs to defined status's when the program is stopped.
If such an instruction has already run in the program and a stop command arises later, the following occurs

- ◆ the current travel motion is interrupted and then
- ◆ a 'Stop program' is run and this is stored as of program line number xxx.

Stop program:

The stop program must not contain

- ◆ any motion commands (POSA, POSR, POSR ..., WAIT POSA, WAIT POSR, SPEED in the speed control mode,),
- ◆ any sub-program jumps (GOSUB, IF ... GOSUB, ...),
- ◆ any COMPAX XX70 - commands,
- ◆ nor any approach real zero or find machine zero commands,
- ◆ nor contain any speed step commands (POSR ... SPEED ...) or
- ◆ any comparator commands (POSR ... OUTPUT ...)

and is used to bring individual outputs (e.g. the control output for a pump or a valve) into a safe status.

Error program with WAIT START

The 'WAIT START' instruction must be contained; it causes the programming procedure to be stopped before an external START is performed again. Then OUTPUT instructions can again be present for resetting the outputs. There must be a RETURN instruction or an END instruction at the end of the stop program.

- ◆ The END instruction stops the program.
- ◆ The RETURN instruction performs a jump back into the previously interrupted program line, a travel motion which was interrupted by STOP is continued; the next command is performed after the BREAK.

Priority:

The error program has priority over the stop program.
A running stop program is interrupted by the error program and continued after the error program has run.

Example:

	Main Program	Stop Program
Arithmetic	N001: IF STOP GOSUB 240	N240: OUTPUT O9=0
Position monitoring	N002: OUTPUT O9=1	N241: WAIT START
Idle display	N003: POSA 0	N242: OUTPUT =9=1
Speed monitoring	N004: POSA 4000	N243: RETURN
Engaging / disengaging brake / final stage	N005: OUTPUT O9=0	
Variable voltage	N006: GOTO 002	

If the axis has been stopped, e.g. during the POSA 4000 positioning, and this was due to a STOP, a sub-program jump is then made to program line 240 and output O9 is set to zero at this point.
The program then stops in program line 241 and waits until a new start occurs. At program line 242, output O9 is switched on again, at program line 243, a jump is made back to the previously interrupted program line N004.
The axis therefore performs the rest of the travel to position 4000, and the main program is then continued at program line N005.
If the stop program is concluded using END rather than RETURN, the program indicator remains in the same position. The program stops running at this point. Machine zero e.g. then has to be approached or the program indicator must be explicitly reset.

7.4.3 Arithmetic**7.4.3.1 Parameter assignments****Syntax:** N001: P40 = 123.456

N002: V19 = P1

The assignments for parameters and variables are defined with an equal sign. The variables are represented by V0 to V39.

Note: The assignment of variables is also possible as a direct command, e.g. from a terminal.

What can be left of the equal sign:

- a parameter Pxxx or
- a variable Vxxx (V0 - V39) or
- a curve point Ixxxx (digital or analogue auxiliary functions when using COMPAX XX70) or
- a curve point Fxxxx (support points when using COMPAX XX70)

What can be right of the equal sign:

- a Operand
or
- a simple arithmetic term¹⁵

An Operand is:

- a parameter Pxxx or
- a variable Vxxx (V1 - V39) or
- a status value Sxxx or
- a constant with max. 8 significant digits + sign + decimal point.

All parameters may be assigned.

The commands "VP" and "VC" (for which you can validate the parameters) can be programmed in the program.

Example:

N123: P081=30 (modifies moment of inertia)
N124: VC

N234: P013=10 (modifies lag tolerance)
N235: VP

Curve memory

COMPAX XX70: the curve memory is also accessible:

Example:

N200: F5450=0.5 (modifies idle position of 1st curve)

N201: I5460=128 (modifies master cycle route of 1st curve)

N202: VF (validates curve)



For more information, refer to the operating instructions for the electrical curve control.

¹⁵ Curve points can only be modified using an assignment; an arithmetic term is not allowed.

7.4.3.2 Arithmetic and variables

Values can be linked with one another using the four basic types of calculation and the result can be assigned to a parameter or a variable.

Syntax: A simple arithmetic term is:

◆ <Operand> <Operator> <Operand>	P10+10; V1-S1; 2*P13; P13/P14; V7\V3; S12%P40
◆ <Command> <Operand>	POSA .V10; SPEED .V30; ...

Operations are not allowed after commands; use variables instead for such cases, e.g..

N001: V001= S1 + 100.5

not allowed: POSA S1 + 100.5

N002: POSA .V001

Operators:

	Function	Example:
+	for addition	P10+10
-	for subtraction	V1-S1
*	for multiplication	2*P13
/	for division	P13/P14
\	for whole number division (creation of the whole number component)	V7\V3: with V7=30 and V3=7 the result is: V7\V3=4 V7/V3=4.2857...; whole number component= 4
%	for the creation of the division remainder (Modulo)	S12%P40 with S12=30 and P40=7 the result is: S12%P40=2 S12/P40=4 remainder 2; division remainder = 2

Operands

The following operands may be used:

- Constants,
- Parameters,
- Status values, (S1-S15, S30, S40ff)
- Variables (V1-V39); after commands with preceding point (full stop): POSA .V1

Status values:

Not all status values make sense as operands.

Permitted are the status values S01 to S15, S30, and S40ff.

Variables:

In addition to the 10 user parameters P40 to P49, **39 variables V1-V39** are available. V0 is used for global assigning of a value to all variables.

The variables are automatically buffer-stored in the ZPRAM, i.e. after Power On they contain the old value.

Note:



After commands, the variables (as is the case for user parameters P40 to P49) are preceded by a "point" (full stop): POSA .V1, ACCEL .V22

Global assignment: V0 is used for globally assigning a value to all variables.
Example:
V0=0: V1...V39=0
V0=17: V1...V39=17

**Arithmetic and
variable
examples:**

N001: P013 = 2 * P013 (Multiplication)
N002: P010 = P040 + 1000.1234 (Addition)
N003: P005 = P005 / 2 (Division)
N004: P250 = P250 - 1 (Subtraction)
N005: V002 = V001 \ 1 (Whole number division)
N006: V3 = S15 % P12 (Modulo)
N007: POSR .V30

Only one operation or command is permitted per program line.

Number format:

All computations are done in a 48-bit format (real number), which contains 24 bits for places before the decimal point and 24 bits for places after the decimal point. Such a real number can be represented with a maximum of 10 places, incl. prefix and decimal point.

Up to 7 places can be recorded after the decimal point.
E.g. 1234567.89; -1.2345678

**Dealing with
calculation errors:**

If a number overrun occurs while an arithmetic term is being calculated (because the range of values is not sufficient or if divided by 0), COMPAX reacts as follows:

- ◆ collective error message E07 is activated.
- ◆ the program is halted for safety reasons.
- ◆ the drive remains powered.
- ◆ any travel movements are broken off using the stop ramp.

After Quit and restart, the same command would be processed again and probably cause another error message.

For this reason appropriate care should be taken when programming.

The causes of the error are stored in the optimization display (P233/P234=39) and the last calculation error stored is always the first to be displayed.

**Accuracy of
calculations:**

Errors occur in the arithmetic due to the systematic errors which arise during the display of figures in the control processor (the smallest number which can be displayed is 2^{-24}).

The calculation error can usually be ignored for addition, subtraction, and multiplication.

Note! When dividing, significant discrepancies can result.

Division $y = x1 / x2$

The "maximum relative input error" for the division $y = x1 / x2$ is calculated using the following formula:

$$\delta \leq \left| \frac{\Delta x_1}{x_1} \right| + \left| \frac{\Delta x_2}{x_2} \right| \quad x_1, x_2 \neq 0 \quad \text{when } \Delta x_1 = \Delta x_2 = 2^{-24}$$

or absolutely:

$$\Delta y = \frac{|x_2| * \Delta x_1 + |x_1| * \Delta x_2}{x_2^2} \quad x_2 \neq 0 \quad \text{when } \Delta x_1 = \Delta x_2 = 2^{-24}$$

Example: x1=12345.6; x2 = 0.0001
Result: y = 123456000

$$\text{max. relative error: } \delta \leq \left| \frac{2^{-24}}{12345.6} \right| + \left| \frac{2^{-24}}{0.0001} \right| = 0.000596$$

Arithmetic

POSA
POSR
SPEED
ACCEL
OUTPUT
Password
SPEED
SYNC
Mark
reference
POSR
SPEED
POSROUTP
UT
WAIT
GOTO
GOSUB
RETURN
END
REPEAT
IF E..
Comparison
WAIT Start
GOTO /
GOSUB EXT
IF Error/ Stop
Arithmetic
Position
monitoring
Idle display
Speed
monitoring
Engaging /
disengaging
brake / final
stage
Variable
voltage

max. absolute error: $\Delta y = \frac{|0.0001| * 2^{-24} + |12345.6| * 2^{-24}}{0.0001^2} = 73585.51$

Reading status and assigning variables

To include the actual position in a calculation, for example, you may assign as follows:

N100: V030=S1

or

N100: V030= S1 + 10

The variable V030 you have derived in this way can be used later, for example, in a positioning instruction as a target preset.

Initializing variables:

After Power On, the variables still hold the old value as before Power Off, since they are stored in the ZPRAM. The special assignment V000=x sets all variables to value x.

Writing convention of variables (V0-V39) and control parameters (P40-P49)

For reasons of compatibility, a preceding point (full stop) is expected in the syntax for motion commands: e.g.: POSA .P40, ACCEL .V10

The new comparison and arithmetic commands can operate without a preceding point (full stop): e.g.: P41=V10+S1, IF V20 > S2 GOTO 10

7.4.4 Position monitoring (P93=1, 2, 3)

Two settings are available for O5 "Position reached" and they are set using P227:

P227 bit 4 ¹⁶ = "1"	Meaning / function
Ba1¹⁷	O5 toggles when the position is reached O5 toggles each time a new positioning process reaches its position.
P227 bit 4 = "0"	
P14>0, small values (small in comparison with the process travel) Ba2	O5 = "1": nominal value reached and lag error < P14 O5="1" if the nominal value sensor has reached the end of the ramp and the lag error is less than P14. If the lag error after O5="1" is again greater than P14, O5 = "0" until the error falls below P14 again.
P14>>0, large value (large in comparison with process travel) Ba3	O5 = "1": nominal value reached (independent of P14) O5 = "1" as soon as the nominal value sensor has finished the ramp descent and remains at "1" until the next positioning process is started.

Functional description:

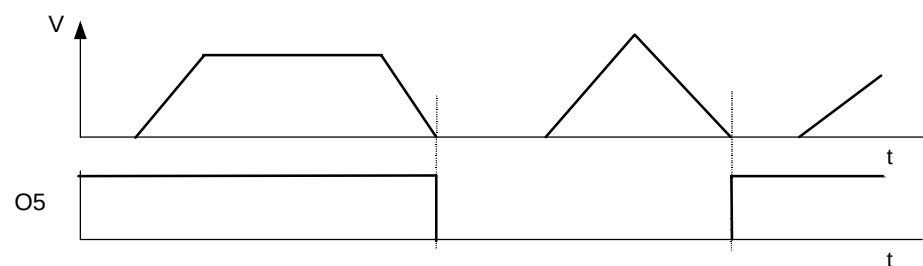
Ba1: O5 toggles when the position is reached

O5 is toggled at the end of all positioning processes (nominal value generator has reached nominal position) (= modified, i.e. when O5="1" modified to O5="0", when O5="0" modified to O5="1").

When an error arises (Exx is shown), O5 remains at the present value.

Can be adjusted using: **P227 bit 4 = "1"**

Example:



SPS - sequential step tracking

With this function you can use a host SPS for precise tracking of the COMPAX positioning. You will find a description of this as of page 94.

Ba2: O5 = "1": nominal value reached and lag error < P14

O5="1": nominal value on nominal value sensor reached and lag error < P14.
If the lag error returns to > P14, then O5="0" is set.

Can be set using: **P227 bit 4 = "0"** (standard setting)

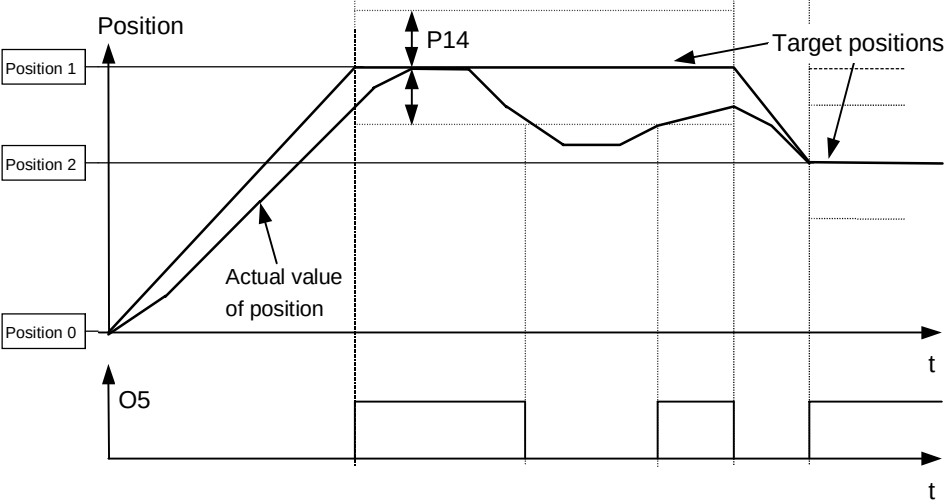
¹⁶ Counting in bits beginning with bit 0.

¹⁷ Ba: Operating mode

Position monitoring (P93=1, 2, 3)

POSA
POSR
SPEED
ACCEL
OUTPUT
Password
SPEED
SYNC
Mark
reference
POSR
SPEED
POSR
SPEED
POSR
UT
WAIT
GOTO
GOSUB
RETURN
END
REPEAT
IF E..
Comparison
WAIT Start
GOTO /
GOSUB EXT
IF Error/ Stop
Arithmetic
Position
monitoring
Idle display
Speed
monitoring
Engaging /
disengaging
brake / final
stage
Variable
voltage

Example:

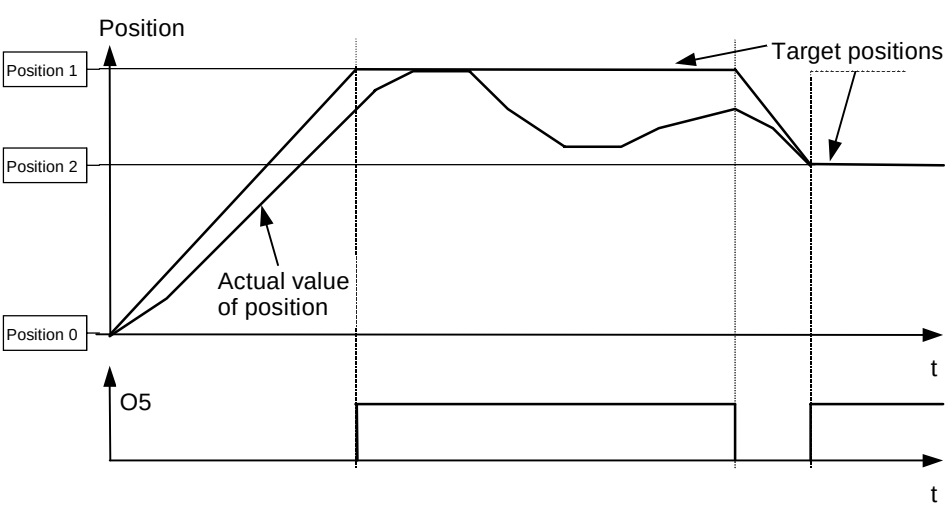


A poor controller setting has been selected by way of illustration.

**Ba3: O5 = "1":
nominal value
reached
(independent of P14)**

O5="1": nominal value on nominal value generator reached (independent of P14, since P14 is set as very large value)
Can be set using: **P227 bit 4¹⁸ = "0"** (standard setting)

Example:



A poor controller setting has been selected by way of illustration.

¹⁸ Counting in bits beginning with bit 0.

7.4.5 Idle display

Display showing whether the axis is at standstill or moving.

The display is set to output O2 using the setting **P227 bit 1¹⁹ = "1"**; the standard function of O2 "No warning" no longer applies in such instances.

P229 then serves as a switching threshold, from which the O2="1" idle message is transmitted and is specified in thousandths of the nominal speed (% of P104).

Nominal speed < P229: O2="1"; drive at standstill

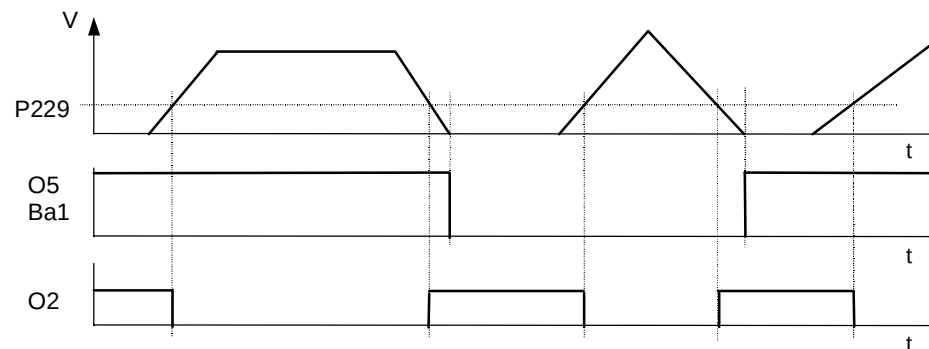
Nominal speed ≥ P229: O2="0"; drive moving

P229 = 0: O2="0"; no idle display

Range of numbers P229: 0 - 255‰

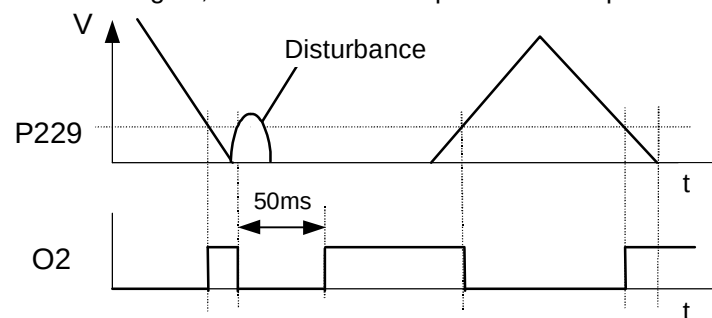
P227 bit 1 = "0" O2 assigned the "No warning" display (standard value).

Example:



To avoid O2 continuously switching over during disturbance to the nominal speed value (during synchronization applications), a minimum pulse time (≡ minimum positioning time) is defined.

Once nominal speed < P229 has been detected and P229 has then been exceeded again, the next nominal speed check is performed after 50 ms.



¹⁹ Counting in bits beginning with bit 0.

7.4.6 Speed monitoring in speed control mode (P93="4")

Two settings are available for O5 "Position reached" and they are set using P227:

P227 bit 4= ²⁰ 1	Meaning / function
Ba1 ²¹ :	O5 toggles when speed is reached O5 toggles every time that a new speed specification is reached.
P227 bit 4 ="0"	
P14>0, small values (small in comparison with the changes in speed) Ba2:	O5 = "1": nominal value reached and < P14 O5="1" if the nominal value sensor has completed the ramp and the difference in speed is less than P14. If the speed difference after O5="1" returns to being greater than P14, O5 = "0" until the value falls below P14 again.
P14>P15 (large in comparison with changes in speed) Ba3:	O5 = "1": nominal value reached (independent of P14) O5=1 as soon as the nominal value generator has reached the nominal speed and remains at "1" until the next speed modification occurs.

Functional description:

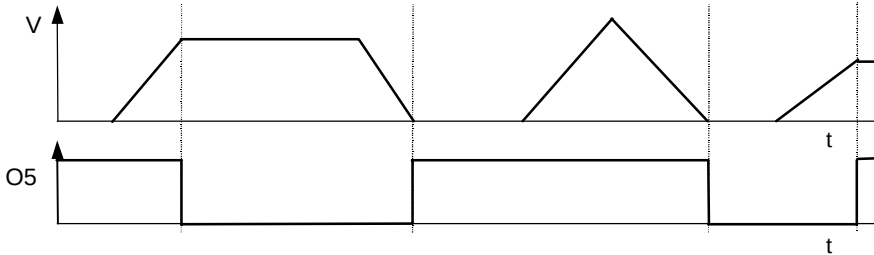
Special features available in speed control mode:

In speed control mode, P14 is given as a percentage of the set speed. In addition, the speed is checked against the speed tolerance defined in P13. P13 is defined in speed control mode as a percentage of the set speed and is an absolute limit.
Speed difference > P13: error E10 is canceled
When P13=0, error E10 (and E49) can be switched off.

Ba1: O5 toggles when speed is reached

O5 is toggled at the end of every speed modification (nominal value generator has reached the nominal speed) (= modified, i.e. when O5="1" modified to O5="0", when O5="0" modified to O5="1").
When errors occur (Exx is displayed), O5 remains at its present value.
Can be set using: **P227 bit 4 ="1"**

Example:



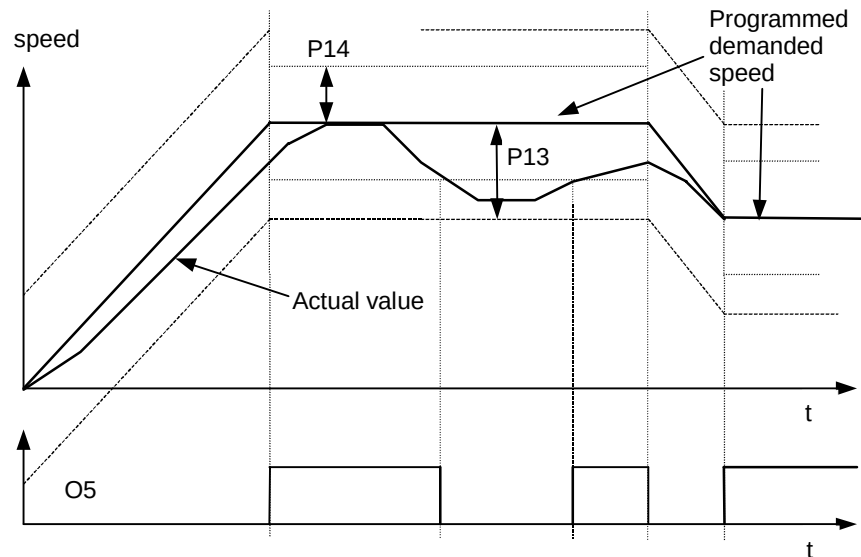
²⁰ Counting in bits beginning with bit 0.

²¹ Ba1: operating mode 1

**Ba2: O5 = "1":
nominal value
reached and lag
error < P14**

O5="1": nominal value reached on nominal value generator and speed deviation < P14.
If the speed deviation returns to > P14, O5="0" is set.
Can be set using: **P227 bit 4 = "0"** (standard setting)

Example:

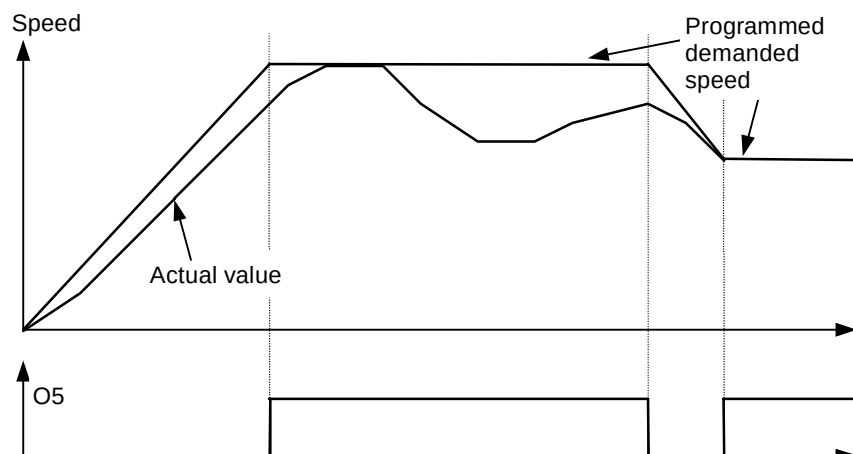


If the actual value moves to outwith of P13, error E10 is triggered.

**Ba3: O5 = "1":
nominal value
reached
(independent of P14)**

O5="1": nominal value reached on nominal value generator (independent of P14, since P14 is set as very large value)
Can be set using: **P227 bit²² 4 = "0"** (standard setting)

Example:



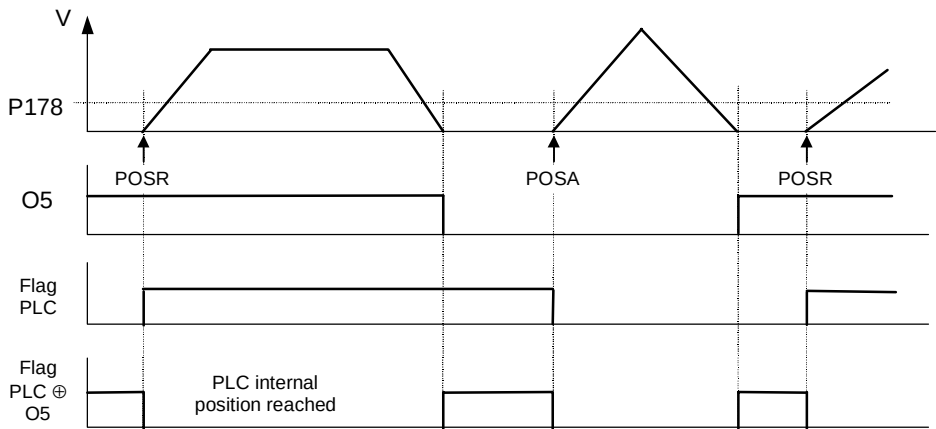
²² Counting in bits beginning with bit 0.

POSA
POSR
SPEED
ACCEL
OUTPUT
Password
SPEED
SYNC
Mark
reference
POSR
SPEED
POSROUTP
UT
WAIT
GOTO
GOSUB
RETURN
END
REPEAT
IF E..
Comparison
WAIT Start
GOTO /
GOSUB EXT
IF Error/ Stop
Arithmetic
Position
monitoring
Idle display
Speed
monitoring
Engaging /
disengaging
brake / final
stage
Variable
voltage

7.4.7 SPS sequential step tracking

Using function "O5 toggles when position/speed is reached" you can implement accurate tracking of the COMPAX positioning using the assistance of a marker in the SPS. This also recognizes positioning processes which are completed again during the next PS cycle.

Implementation:

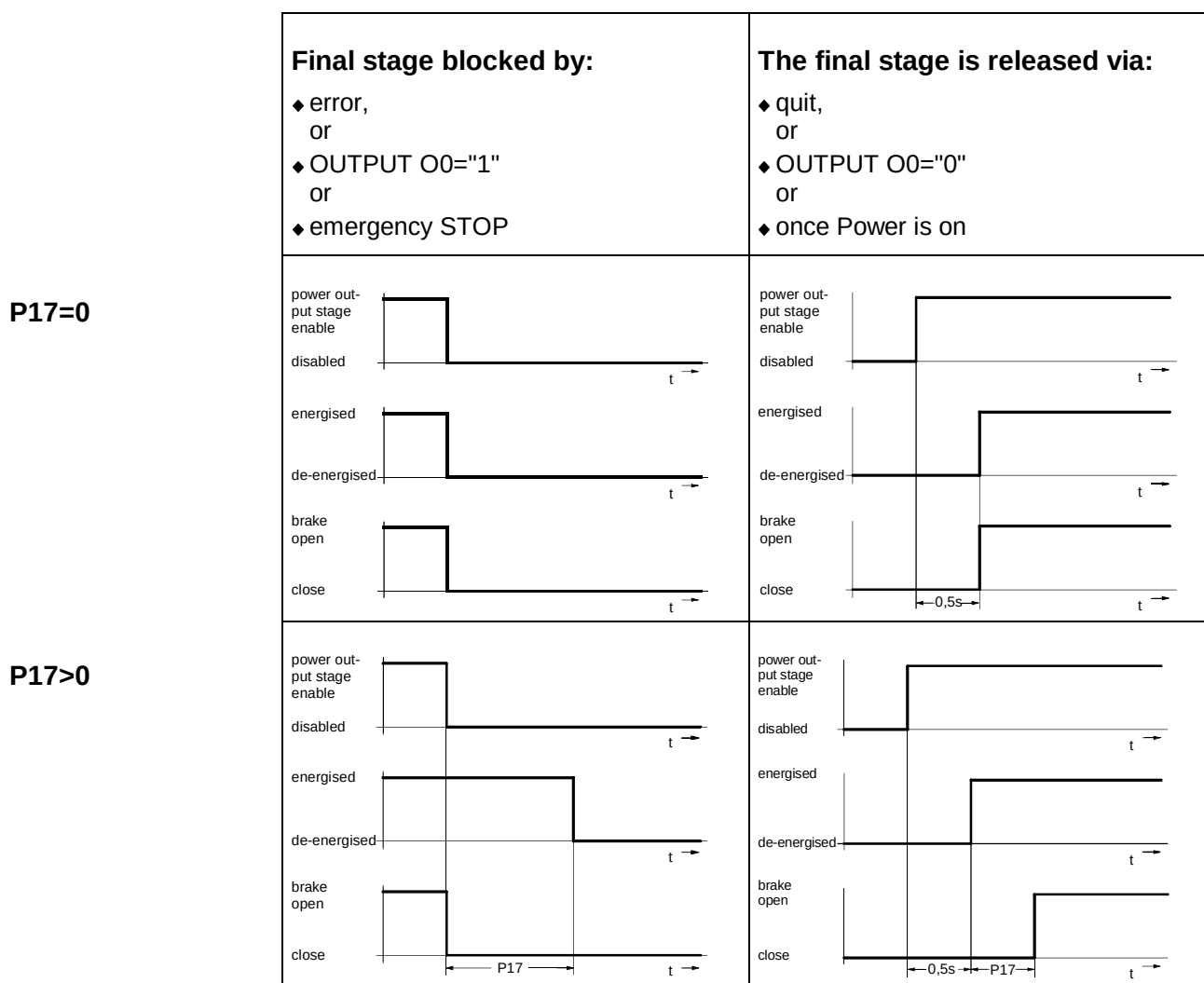


The SPS marker is toggled when a positioning command is transmitted. The "EXCLUSIVE OR" linking of the SPS marker and output O5 can be analyzed as SPS internal "Position reached message".

7.4.8 Engaging and disengaging the motor brake and final stage

COMPAX controls the idle holding brake of the motor and final stage. The temporal characteristics can be selected using P17.

Application: If you are using an axis which is under torque when idle (e.g. when using a z axis), the drive can be engaged and disengaged in a manner which ensures that the load does not move. To do this, the drive remains powered during the reaction time of the idle holding brake. This can be set using P17 (refer to the following diagrams).



Range of values for P17:

Meaning	Unit	Minim. value	standard	Maximum value	Applies to ...
Braking delay	ms	0	0	500	VP

7.4.9 Output of variable voltage

The direct output of variable voltage is supported via the D/A monitor channels 0 to 3.

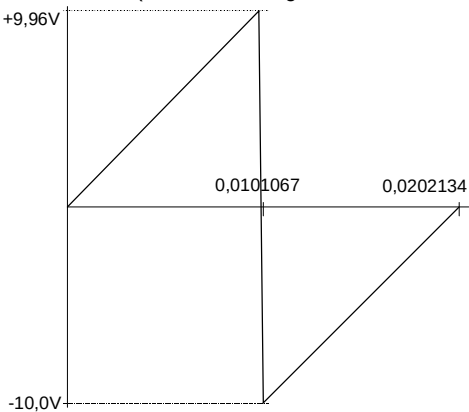
Service D/A monitor (channels 2 & 3):

Accessible using parameters P76 (channel 2) and P77 (channel 3)
 P76 Channel 2 X11/4
 P77 Channel 3 X11/5
 Resolution: 8 bit (incl. sign); corresponds to a resolution of 80 mV
 Range: -10V...+10V
 The calculation for output on the 8 bit channels 2 & 3 is as follows:
 Parameter setting for desired voltage U (-10V ... +10V)
 $P76 (P77) = 39 + Y$ (39,Y)
 39: selection of voltage output

Value before decimal point:
 Value after decimal point:

For positive voltage: $Y = U * 0.0101067 / 10V$
 For negative voltage: $Y = U * 0.0101067 / 10V + 0.0202134$
 (Note: sets U negative in the 2nd formula)

Characteristic curve:



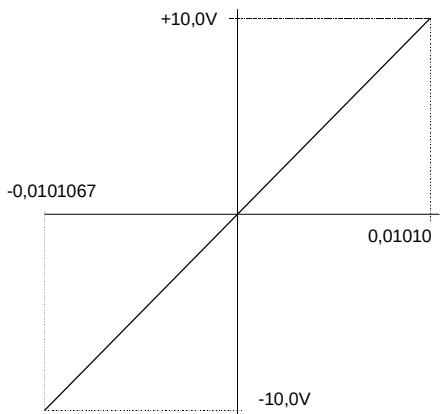
Option D/A monitor (channels 0 & 1):

Accessible using P71 (channel 0) and P72 (channel 1)
 P71 Channel 0 X17/1
 P72 Channel 1 X17/2
 Resolution: 12 bit (incl. sign); corresponds to a resolution of 5 mV
 Range: -10V...+10V
 The calculation for the output on the 12-bit channels 0 and 1 is as follows:
 Parameter setting for desired voltage U (-10V ... +10V)
 $P71 (P72) = Y$
 P73 (P74) = 39: selection of voltage output

Calculating the output value:

$$Y = U * 101067 / 10V$$

Characteristics curve:



7.5 Optimization functions

7.5.1 Optimizing controller

P23: rigidity of drive

The rigidity is proportional to the control responsiveness.

Nominal value: 100% Range: 10%...5000%

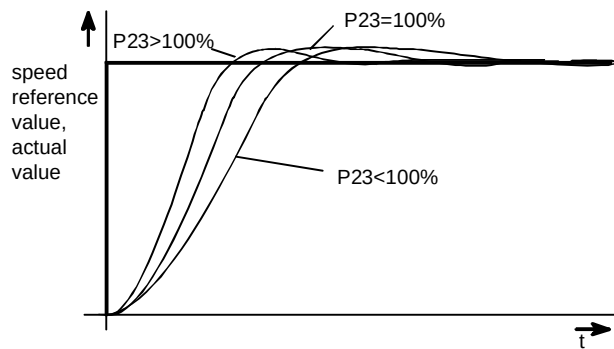
Increasing rigidity

The control process is faster. The control circuit starts as of a critical value. Sets the rigidity in a manner which ensures that there is a sufficiently safe distance to the critical value.

Reducing rigidity

The control process is slower. This in return increases the lag error. The current limitation is reached later.

Main effect:



P24: dampening of drive

The dampening influences the height of the harmonics and reduces the vibrations.

Nominal value: 100% Range: 0%...500%

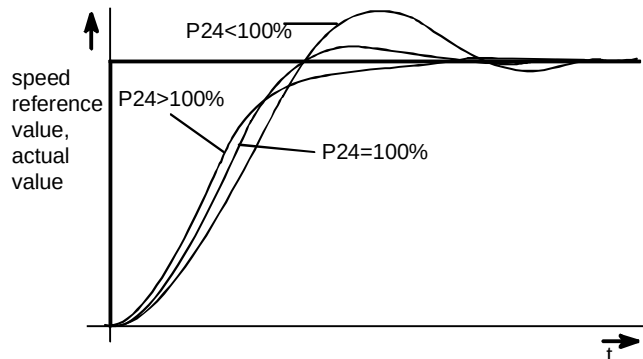
Increasing dampening

The harmonics become smaller. The drive vibrates at high frequency as of a specific value.

Reducing dampening

The harmonics of the actual value becomes stronger and it vibrates longer by the nominal value. The drive vibrates permanently as of a specific value.

Main effect:



Advance control measures

Advance control of speed, acceleration and power

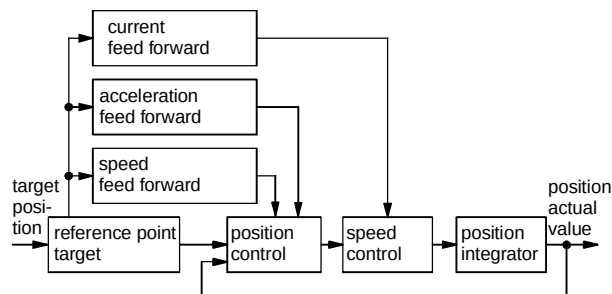
Advantages:

- ◆ Minimum lag error
- ◆ Better attenuation characteristics
- ◆ Higher levels of dynamism with lower maximum current

Principle:

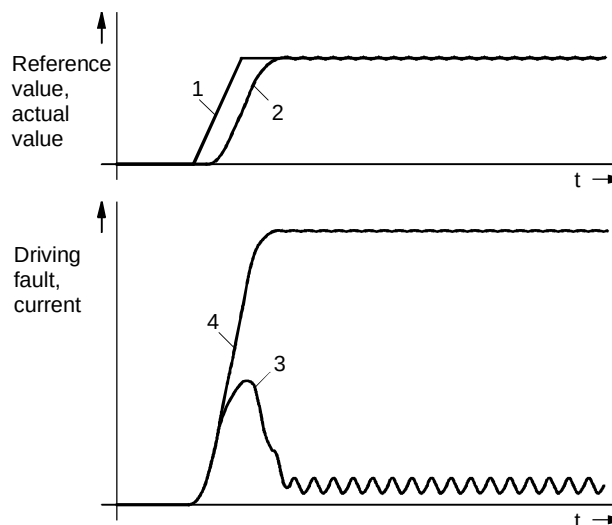
The positioning process is calculated in the nominal value setter and is specified to the position controller as the nominal value. This ensures that the nominal value setter contains the advance information required for the positioning: speed, acceleration and power process. The lag error is reduced to a minimum so that this information can be switched to the controller, the controller has better attenuation characteristics and the levels of drive dynamism are increased.

Main structure:



The stability of the control process is not influenced by the advance control measures.

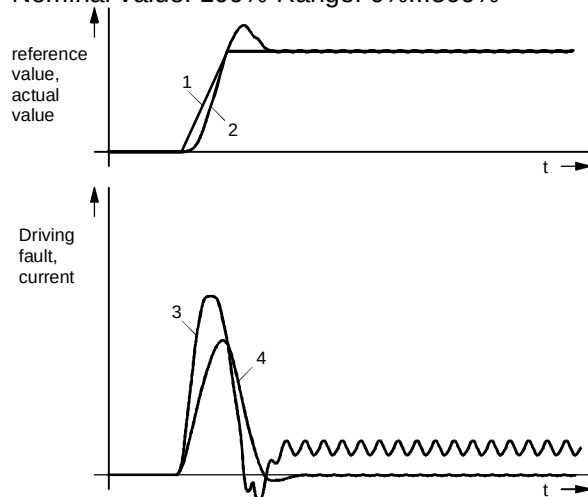
Without advance control measures:



- 1: Nominal speed value
- 2: Actual speed value
- 3: Motor power
- 4: Lag error

P25: Advance speed control:

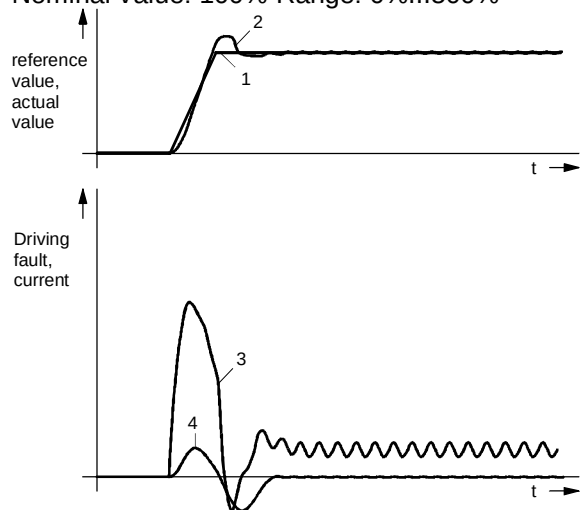
Advance speed control
Nominal value: 100% Range: 0%...500%



- 1: Nominal speed value
- 2: Actual speed value
- 3: Motor power
- 4: Lag error

P26: Advance acceleration control

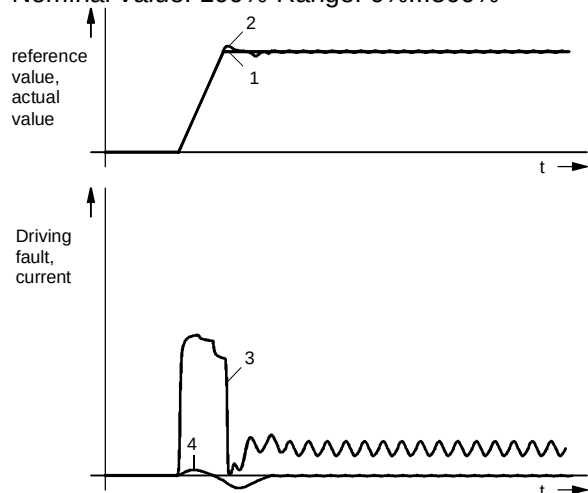
Advance speed and acceleration control
Nominal value: 100% Range: 0%...500%



- 1: Nominal speed value
- 2: Actual speed value
- 3: Motor power
- 4: Lag error

P70: Advance power control

Advance speed, acceleration and power control
Nominal value: 100% Range: 0%...500%



- 1: Nominal speed value
- 2: Actual speed value
- 3: Motor power
- 4: Lag error

Advance reverse control

The advance reverse control can be engaged to add to the optimization of the guide characteristics and to thereby reduce the dynamic lag error. This is engaged using P69. Range: 0 ... 500% Standard value: 0; applies to VP

Optimizing controller

P27: moment of inertia

You can use this parameter to adapt the controller to very large changes in load.

Nominal value: 100% Range: 10%...500%

COMPAX is informed of the relative change in moment of inertia which occurs before a change in load when the motor is idle (e.g. via the RS232 interface).

The nominal value (100%) corresponds to the value calculated by parameters P81 to P92.

Control processes for optimization

Targets / problems	Rigidity (P23)	Damping (P24)	Advance control factors (P25, P26, P70)	Acceleration time (ACCEL)	Ramp shape (P94)	Other measures
Minimizing lag error	increase	-	=100% optimize if necessary	increase	-	-
No harmonics	-	increase	decrease	increase	quadratic (P94="3")	increase max. torque (P16)
Unusually high harmonics caused by power limitation	decrease	decrease	decrease	increase	linear (P94="1")	increase max. torque (P16)
Vibrating at higher frequencies (perceptible as noise)	decrease	decrease	-	-	-	check min. ground/earth (P92) and/or min. moment of inertia (P81).
Vibrating at lower frequencies (perceptible as motion)	-	increase	-	-	-	check max. ground/earth (P88) and/or max. moment of inertia (P82).
High motor or final stage temperatures	decrease	-	-	increase	linear (P94="1")	decrease max. torque (P16)

Additional technical control optimization functions

Variants of controller structure

The ParameterEditor function enables you to access 2 further variants of the control structure besides the standard structure. (This is not the case if the system is operated with an asynchronous motor, since the structural variants make use of the motor speed monitor; see below).

Depending upon your application and the method used for recording the motor position (resolver or sincos), you can achieve a substantial increase in controller efficiency (p23), and consequently in control dynamics, with the extra structural variants.

The structural variants can be accessed via the menu "Parameters: controller: control structure" in ParameterEditor.

It is not possible to directly access the structural variants with parameters (via bus or terminal).

7.5.2 Optimization display

The optimization display (status S13 and S14) is an aid for optimizing COMPAX without the need for an additional visual aid. It provides you with access to the characteristic parameters of the positioning process (optimization parameters). From a selection of 14 different parameters for the positioning process, you can assign 2 parameters to the status values S13 and S14 by using the parameters P233 (S13) and P234 (S14).

The optimization parameters are reset before each new positioning process and they are continually updated during the positioning process.

Optimization parameters:

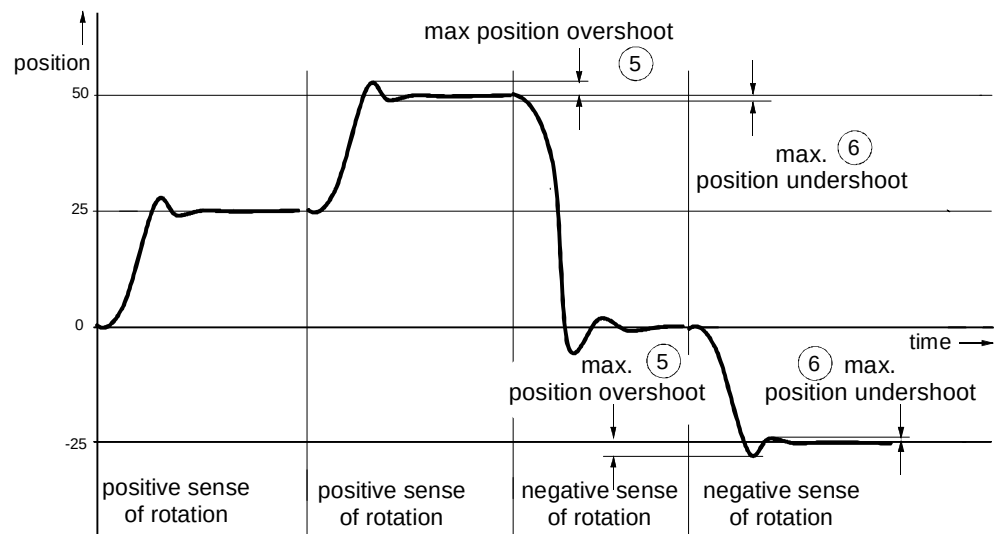
P233/P234 ²³	Meaning
1	Positioning time (from start of positioning to "position reached")
2	max. intermediate circuit voltage in [V]
3	reserved
4	max. undershoot referenced to max. position (amount) (only for highly misadjusted loops)
5	max. position overshoot [units corresp. P90] (amount)
6	max. position undershoot [units corresp. P90] (amount)
7	max. acceleration lag error [units corresp. P90]
8	max. braking lag error [units corresp. P90]
9	max. acceleration speed in [%] of motor nominal speed
10	max. braking speed in [%] of motor nominal speed
11	max. acceleration current in [%] of motor nominal current
12	max. braking current in [%] of motor nominal current
13	max. time in current limit for acceleration, in [ms]
14	max. time in current limit for braking, in [ms]
56	square root of peak motor current (reference value: 80 000A ²)

The number corresponding to the first column should be entered in the parameter. The following applies:

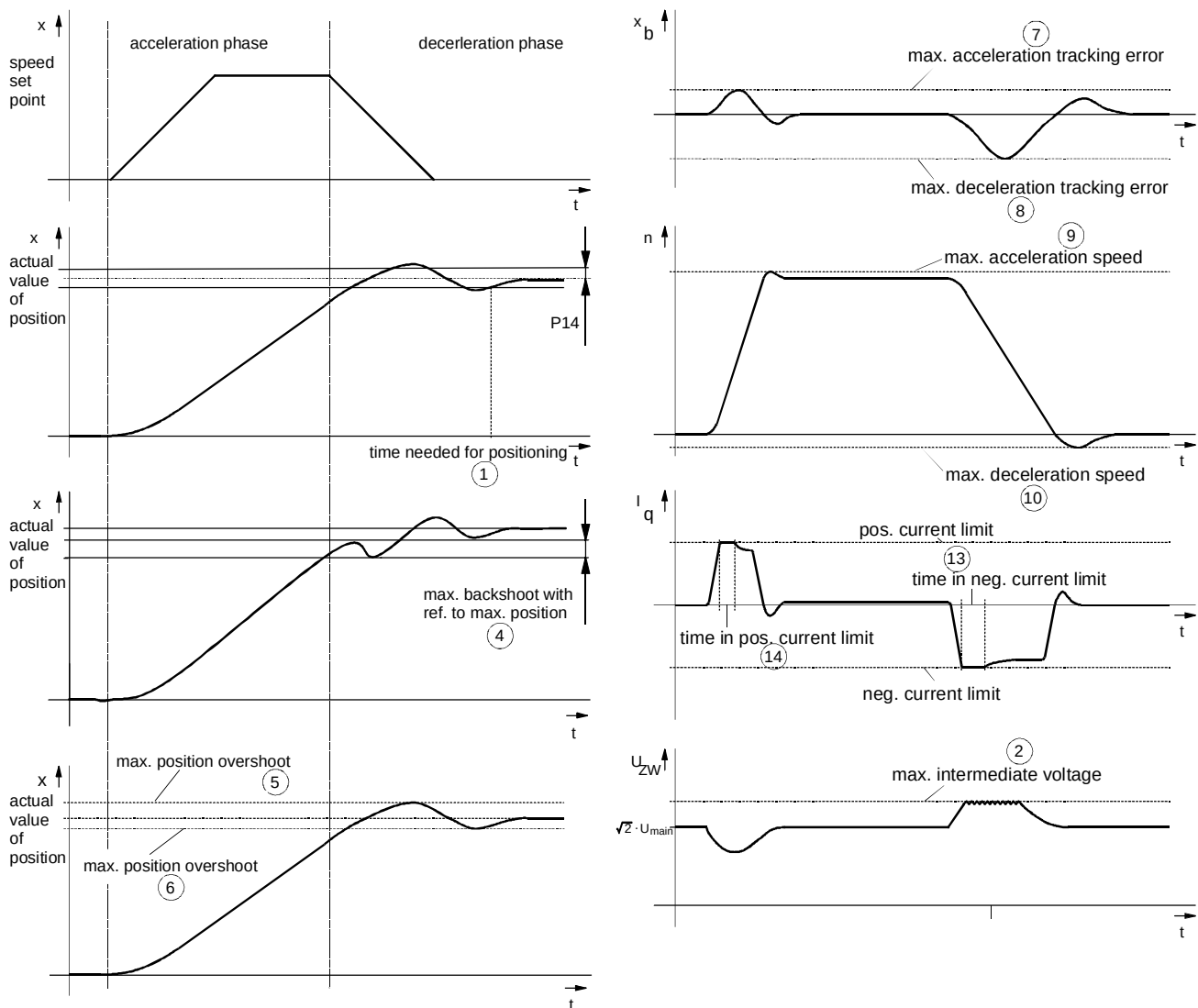
◆ P233 determines status S13

P234 determines status S14

Description of optimization parameters



²³ P233/P234 are set as valid with VP



➡ You can find a complete status list on page 160.

Square root of peak motor current

Reference value: 80 000A²

The maximum peak current of a motor phase is continually determined once COMPAX is switched on and this is stored as status S13 or S14 using P233/234=56.

This display is generated as long as the motor is powered. The value is reset when COMPAX is switched off (after "OFF").

Obtaining the peak motor current using S13 (P233=56) as an example:

$$I_{\max} = \sqrt{S13 * 80\,000A^2}$$

Via the effective value

$$I_{\text{eff}} = \frac{I_{\max}}{\sqrt{2}}$$

you can calculate the peak load within your motor cycle.

If this value should rises to 1.5 times the peak current of the system, error E41 is triggered.

You can find more detailed explanations on the limiting characteristics of COMPAX on page 178.

Access to additional parameters via S13 and S14:

P233/P234	Meaning
15	Current number of HEDA transmission errors
16	Average no. of HEDA transmission errors per second
17	Total number of HEDA transmission errors since beginning of synchronization
18	Process nominal value received via HEDA
19	HEDA control word Bit 3 ²⁴ : Transmission error COMPAX -> IPM Bit 8: fast start via HEDA
20	HEDA status word Bit 0="1": no errors (corresponds to COMPAX output O1) Bit 1="1": no warnings (corresponds to COMPAX output O2) Bit 3="1": transmission error IPM -> COMPAX Bit 8="1": COMPAX lag warning (= "1" - in position, i.e. within lag warning window) Bit 9="1": HEDA interface active (COMPAX synchronized) Standard setting: Bit 0="1", Bit 1="1", Bit 3="0", Bit 8="1", Bit 9="1": S13/S14=771
21	CPX X50 max. pos. synchronous lag error [units corresp. P90]
22	CPX X50 max. neg. synchronous lag error [units corresp. P90]
23	Output value of D/A monitor channel 0 (10V corresponds to 1)
24	Output value of D/A monitor channel 1 (10V corresponds to 1)
25	Output value of service D/A monitor channel 2 (10V corresp. to 1)
26	Output value of service – D/A monitor channel 3 (10V corresp. to 1)
27	External encoder position (units corresp. P90)
28	Measuring error (Difference between resolver position and external encoder position in the unit corresponding to P90)
29	Effective motor load in % of the permitted continuous motor load (E53 is displayed as of 100%)
30	Effective unit load in % of the permitted continuous unit load (E53 is displayed as of 100%)
31	Label synchronization function indicator (COMPAX XX70)
32	"Standardized correction factor" (COMPAX XX70)
33	"Cycle counter" (COMPAX XX70)
35	Digital inputs I1-I16
36	Status S16 (bits 16...23) and digital outputs O1-O16 (bits 0...15)
37	Encoder frequency channel 4 in incr./ms" (COMPAX XX60, COMPAX XX7X)
39	Cause of calculation error E07 0 Invalid operator 1 Division by 0 2 Overflow 3 Underflow

You can find the meanings of the DA monitor values on page 39.

The number corresponding to the first column should be entered in the parameter.
The following applies:

♦ P233 determines status S13 & P234 determines status S14

➡ You can find additional special diagnosis values on page 163.

²⁴ Counting in bits beginning with bit 0.

7.5.3 Speed monitor

Speed determination standard:

In COMPAX the drive speed is required as an actual value for speed control (loop underlying the position control).
The actual speed value is derived by differentiating the position signal.
In certain applications, such as with large ratios J_{load}/J_{motor} , the loop response time is limited by quantization noise.

Speed monitor:

COMPAX has implemented a speed monitor for determining speed, which can be turned on using parameter P50.

By using the speed monitor you are able to set a higher level of rigidity which corresponds to a faster control process.

Function:

The monitor reproduces the dynamic behavior of the drive. It receives the same input signal as the physical drive. Using an additional loop its output magnitude is compared with the actual output magnitude of the drive (actual position value from resolver) and held to the same value. The additional loop makes corrections to the internal monitor values.

The advantage is that the speed is available directly as an intermediate value of the monitor and can be used for speed control.

You can use this speed signal to attain a stable control process or to operate the drive control process with higher levels of rigidity (P23) and the same levels of damping.

Settings:

P50=100: without monitor (standard setting and function as before)

P50=101: with monitor

P151: responsiveness of the monitor control (standard 30%)

P151>30%: monitor loop becomes faster

P151<30%: monitor loop becomes slower

Using the speed monitor

- For large ratios J_{load}/J_{motor} .



Attention! You do not have to use the speed monitor when you are operating asynchronous motors.

7.5.4 External position management with position adjustment

Only available in COMPAX XX00!

The external position management with position adjustment is available in the following described versions, only in the standard unit (COMPAX XX00). Solutions adapted to the application in question are realized in the unit variants.

A slip between motor position and the position of the drive (e.g. a material feed) is not detected. If the slip is too large, you can read the external position (e.g. recorded by a measuring wheel) using encoder channel 1. In this way, COMPAX corrects the internal actual position value.

To limit access to the position adjustment, you can use P36 to limit the speed correction value resulting from the difference in positions.

This can be especially useful in the acceleration phase, if the material is slipping through because of the higher correction speed.

Recommendation:

To avoid all inaccuracies during internal calculations, it is important that you use the measuring unit "Increments".

Configuring the external position adjustment:

Parameter	Meaning	valid as of..
P75	Maximum permitted measuring error (difference between resolver position and encoder position) The external position adjustment is engaged using measuring error P75 > 0. When P75 is reached, error E15 is created and the drive is switched off. Controls the position adjustment via digital input I11 When the external position management with position adjustment is engaged (P75>0), access to the position adjustment via input I11 can be engaged and disengaged. For this you must assign I11 with this function via P232=4. I11="0": External position adjustment disengaged (reaction time approx. 5 ms). I11="1": External position adjustment switched on. P232 becomes effective immediately and has a standard value of 0. When P232=0, I11 has no effect on the position adjustment; this is then engaged and disengaged using P75. Note! When P232=4 (activated I11), I11 can no longer be used for GOTO / GOSUB EXT.	VP
P36	Limitation of speed correction value for external position adjustment (only available in COMPAX XX00 and COMPAX XX30) "0": switched off (standard value) When P36=0, the speed correction value is not limited. P36 is specified in % of the nominal speed (P104). Note! When position management is switched off, P36 must=0!	VP

Parameter	Meaning	valid as of..
P144	Sets encoder channel 1 ="4": without external position management ="6": external position management switched on via channel 1.	VC
P143	Number of encoder pulses per encoder rotation from channel 1; range: 120...2 000 000.	VC
P98	Travel of load per encoder rotation units (corresp. to P90).	VC
P214	Encoder direction. ="0": positive direction for encoder rotating clockwise. ="1": positive direction for encoder rotating anti-clockwise. Setting aid: ♦ Switch of external position adjustment (P44=4) and data record P214=0. ♦ Note down S42 (position of external sensor). ♦ Proceed with POSR x axis. ♦ S1 and S42 must have been modified by the same value (x). • If the prefix of the modification are different, data record P214="1". • If the modification is by different amounts, check P143 and P98.	VP



The command "SPEED SYNC" cannot be used in external position management!

Limit values of parameters

A number overrun is possible in special applications. To rule out the possibility of this occurring, the following condition must be satisfied: $V \geq 1$

Determine V depending on the drive type and the measuring unit:

Drive type	Measuring unit	Determining V
Spindle drive	mm (inch)	$V = K \cdot P85 (\cdot 25,4)$
Rack-and-pinion/ toothed belt	mm (inch)	$V = K \cdot \frac{P85}{P82} (\cdot 25,4)$
General drive	mm (inch)	$V = K \cdot 1000 (\cdot 25,4)$
General drive	Incr.	$V = K$

Using

$$K = \frac{P98 \cdot 16384}{P83 \cdot P143}$$

Slip filter for external position management

A slip filter with a differentiating element (D-element) is provided to optimize external position adjustment.

No.	Meaning	Unit	Minimum value	Default value	Maximum value	valid as of...
P67	D-element slip filter	%	0	100	500	VP
P68	Slip filter delay	%	0	100	5000	VP

Both parameters are set to 100% as standard. The time constants are then identical and the filter ineffective. Meaning:

Parameter	Effect	Application
P67 = P68	Filter ineffective (standard)	
P67 < P68 or P67 = 0	Filter has delaying effect	♦ Low resolution of measuring system ♦ Interference of measuring signal
P67 > P68	Filter has differentiating effect	For high dynamic requirements. Conditions: high-resolution measuring system and low interference of measuring signal.

7.6 Interfaces

The COMPAX interfaces for data and status are digital inputs with an SPS data interface, an RS232 interface and optionally a bus interface (interbus S, CAN bus, CANopen, profibus, CS31 or RS485).

The RS232 interface can be simultaneously operated with other interfaces.

7.6.1 Digital inputs and outputs

16 inputs and 16 outputs are available to help you control the programming procedure.

➡ O7-O11 and I7-I11 are assigned when the SPS data interface is switched on.

**I / O -
assignment of
standard unit**

Input	Significance
I1 (X8/1)	SHIFT
I2 (X8/2)	Hand+
I3 (X8/3)	Hand–
I4 (X8/4)	Quit
I5 (X8/5)	Start
I6 (X8/6)	Stop (interrupts data record)
I7 (X8/7)	Free for assignment in the standard unit.
I8 (X8/8)	Free for assignment in the standard unit.
SHIFT I2	Find machine zero (MN)
SHIFT I3	Approach real zero (RZ)
SHIFT I4	Teach real zero
SHIFT I5	reserved
SHIFT I6	Break (breaks off data record)
I9 (X10/1)	Free for assignment in the standard unit.
I10 (X10/2)	Free for assignment in the standard unit.
I11 (X10/3)	Assigned when P232=4 (activates position adjustment); otherwise free.
I12 (X10/4)	Free for assignment in the standard unit.
I13 (X10/5)	Free for assignment in the standard unit.
I14 (X10/6)	Assigned when mark reference is activated (P35=1) (activates mark reference); otherwise free.
I15 (X10/7)	Fast start (can be activated using P18)
I16 (X10/8)	Is assigned if mark reference is activated (P35=1) (mark input); otherwise free.

Output	Significance
O1 (X8/9)	= "1": no interruption = "0": errors E1 ... E58; the drive does not accept any positioning commands. Once "Power on", O1 remains at "0" until the self-test has been performed.
O2 (X8/10)	= "1": no warning = "0": error ³ E58
O3 (X8/11)	Machine zero has been approached
O4 (X8/12)	Ready for start
O5 (X8/13)	Programmed nominal position reached
O6 (X8/14)	Idle after stop
O7 (X8/15)	Free for assignment in the standard unit.
O8 (X8/16)	Free for assignment in the standard unit.
O9 (X10/9)	Free for assignment in the standard unit.
O10 (X10/10)	Free for assignment in the standard unit.
O11 (X10/11)	Free for assignment in the standard unit.
O12 (X10/12)	Free for assignment in the standard unit.
O13 (X10/13)	Free for assignment in the standard unit.
O14 (X10/14)	Free for assignment in the standard unit.
O15 (X10/15)	Free for assignment in the standard unit.
O16 (X10/16)	For "0": marker disappears after max. feed length ²⁵

7.6.1.1 Free assignment of inputs and outputs

Free assignment of inputs

You can make the permanently assigned standard inputs I1 to I6 available for assignment using parameter P221. Meaning:

Input	Function without SHIFT	Function with SHIFT	Valency
I1 (X8/1)	SHIFT	-	1 (Bit 1) ²⁶
I2 (X8/2)	Hand+	Find machine zero (MN)	2 (Bit 2)
I3 (X8/3)	Hand-	Approach real zero (RZ)	4 (Bit 3)
I4 (X8/4)	Quit	Teach real zero	8 (Bit 4)
I5 (X8/5)	Start	reserved	16 (Bit 5)
I6 (X8/6)	Stop	Break (breaks off data record)	32 (Bit 6)

Setting P221

Each input is assigned a valency. Calculate the sum of the valencies of the inputs you want free and enter this in parameter P221.

Example:

Hand+ and Hand- should be possible via the inputs; I1, I4, I5 and I6 should be freely available.

$$1 (I1) + 8 (I4) + 16 (I5) + 32 (I6) = 57$$

You will attain this setting using P221 = 57.



Note that when I1 is freely assigned (SHIFT), you can no longer perform any "Functions with shift" via the inputs!



You can directly cancel all input functions (apart from Hand+ and Hand-) as commands using interfaces (RS232, bus system).

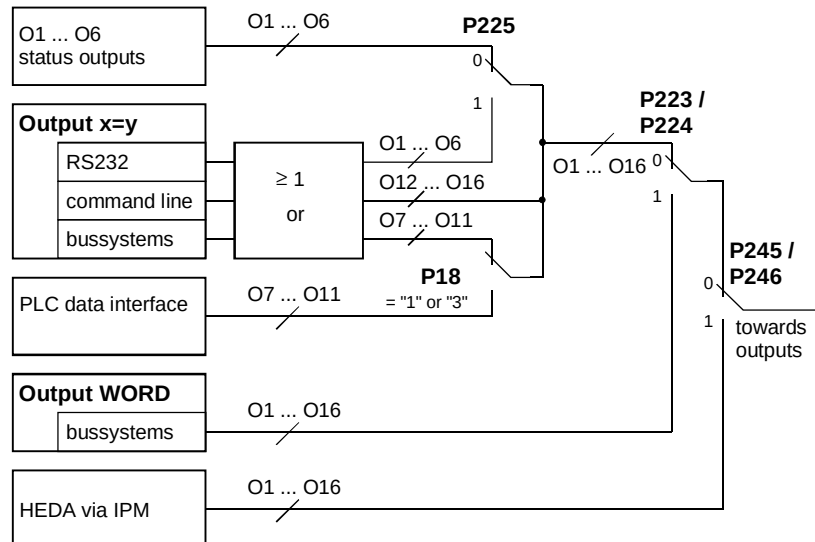
²⁵ Only assigned if the mark reference is activated (P35=1).

²⁶ Counting starts at 1.

Free assignment of outputs

- ◆ The status outputs O1 to O6 can be freely assigned using parameter P225.
- ◆ By using P223 and P224 you can assign the outputs to the OUTPUT WORD command of the bus systems (interbus S, profibus, CAN – bus, ...).
- ◆ By using P245 and P246 you can assign the outputs to the HEDA bus (COMPAX with IPM via the option A1).
- ◆ Permanently assigned outputs of unit variants (COMPAX XX30, ...) cannot be masked.

Structural diagram



Explanation:

P225: makes outputs freely available.

The permanently assigned standard outputs O1 to O6 can be made freely available using parameter P225. Meaning:

Output	Function	Valency
O1 (X8/1)	= "1": no interruption = "0": errors E1 ... E58	1 (Bit 1) ²⁷
O2 (X8/2)	= "1": no warning = "0": errors ³ E58	2 (Bit 2)
O3 (X8/3)	Machine zero has been approached	4 (Bit 3)
O4 (X8/4)	Ready for start	8 (Bit 4)
O5 (X8/5)	Programmed nominal position reached	16 (Bit 5)
O6 (X8/6)	Idle after stop	32 (Bit 6)

Setting P225

Each output is assigned a valency. Calculate the total of the valencies for the outputs that you want free and enter this in parameter P225.

Example:

"Ready for start" and "Idle after stop" should be possible via the outputs; O1, O2, O3 and O5 should be freely available.

$$1 (O1) + 2 (O2) + 4 (O3) + 16 (O5) = 23$$

You attain this setting using P225 = 23.



Using the interfaces (RS232, bus systems) and using the data record program, the outputs can optionally (in parallel) be described using OUTPUT Ax=y.

SPS data interface

When the SPS data interface is activated, the outputs must not be addressed using the interfaces (RS232, bus systems) or using the data record program.

Note!

This must not simultaneously be used with the OUTPUT WORD command or with HEDA !

²⁷ counting starts at 1.

Switching to OUTPUT WORD command or to HEDA bus

P223 / P224: switching to OUTPUT WORD command

P245 / P246: switching to HEDA bus

Access to the outputs can be set as bits to the OUTPUT WORD command or to HEDA. Only the released outputs are then described by the OUTPUT WORD command or by HEDA.

Outputs	OUTPUT parallel	HEDA
	P223	P245
O1	1 (Bit 1) ²⁸	1 (Bit 1)
O2	2 (Bit 2)	2 (Bit 2)
O3	4 (Bit 3)	4 (Bit 3)
O4	8 (Bit 4)	8 (Bit 4)
O5	16 (Bit 5)	16 (Bit 5)
O6	32 (Bit 6)	32 (Bit 6)
O7	64 (Bit 7)	64 (Bit 7)
O8	128 (Bit 8)	128 (Bit 8)
	P224	P246
O9	1 (Bit 1)	1 (Bit 1)
O10	2 (Bit 2)	2 (Bit 2)
O11	4 (Bit 3)	4 (Bit 3)
O12	8 (Bit 4)	8 (Bit 4)
O13	16 (Bit 5)	16 (Bit 5)
O14	32 (Bit 6)	32 (Bit 6)
O15	64 (Bit 7)	64 (Bit 7)
O16	128 (Bit 8)	128 (Bit 8)

Setting P223, P224, P245, P246

Each output is assigned a valency. Calculate the total of the valencies of the outputs you want to free and enter this in the relevant parameter.

Example:

O4 to O16 should be influenced by the OUTPUT WORD command; O1, O2 and O3 should be available via OUTPUT Ox=y.

$8 (O4) + 16 (O5) + 32 (O6) + 64 (O7) + 128 (O8) = 248$

When P223 = 248 and P224 = 255 (total of all valencies), you will attain this setting.

²⁸ Counting starts at 1.

7.6.1.2 I / O assignment of the variants**COMPAX XX30:
Round table
control**

I12: releases final stage
 I13: compensates for measuring error by external position management
 I14: releases brakes
 O14: no measuring error
 O16: final stage switched off

**COMPAX XX50:
Synchronous
cycle control**

I6: STOP is not effective during a synchronization process.
 I1&I6: BREAK interrupts the synchronization process.
 I12: Material simulation
 I13: Manual step
 I14: Switches on mark reference
 I15: Ends synchronous travel
 (The "Fast start" function is not possible)
 I16: Mark input
 O5: Position reached at synchronization command (WAIT POSA, WAIT POSR)
 ="0": when idling the axis
 ="1": after return run.
 O14: Synchronous comparator
 O15: Chaff length
 O16: Reject length

**COMPAX XX60:
Electronic
transmission**

I14: Switches over the dimension reference
 I15: Transmission factor selection
 I16: Releases master nominal value

**COMPAX XX70:
Curve disc
control**

I12: Releases final stage
 I13: ="0": Decoupling ="1": Coupling
 I14: Mark input.
 I15: ="0": Disables auxiliary functions ; ="1": Enables auxiliary functions
 I16: Releases master position
 O7...O14: Digital auxiliary functions.
 O13/O14: Cannot be used via OUTPUT.
 O14: Mark not in mark window.
 O15: Lag warning
 O16: Synchronous run

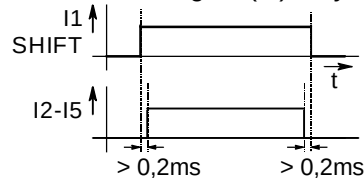


Please refer to the instructions for the variant you are using for up-to-date information!

7.6.1.3 Function of inputs

When working with pre-assigned inputs, always note the following:

- ◆ The SHIFT signal (I1) may only change if I2...I5 = "0".



- ◆ The "STOP" and "BREAK" functions (input I6) have top priority.
- ◆ For the inputs I1 to I5, only the first input present will be detected and the relevant function activated. The other functions are then blocked; this means e.g.:

If Quit (I4) is set during a process involving Hand+ (I2="1"), Quit is not detected even after I2="0". A new rising flank will be required for Quit (I4).

Exception: START

If a program is interrupted by STOP when START is present (I5), the program is then continued using I6="0" (STOP is deactivated).

Length of signal ³
1ms

The signals must be present for ³ 1 ms if you are to be sure of detection.

SHIFT

Input I1



- ◆ Switches to the functions for inputs I2 to I6.
- ◆ Signal I1 may only change if I2...I6 = "0".

Hand+/Hand-

Input I2/I3



- ◆ Processes the axis in manual mode (velocity: P5; ramp time: P9).
- ◆ Conditions for manual procedure:
 - ◆ The axis must be stationary and powered.
 - ◆ No program may run.
 - ◆ When the end limits are reached (P11, P12), the drive is stopped.
- ◆ The outputs O5 "Nominal position reached" and O4 "Ready for START" are at "0" during manual mode; O5 remains at "0" even once manual mode has been completed.

QUIT

Input I4



- ◆ Acknowledges an error message or warning.
- ◆ If the error is rectified, O1 "No interruption" or O2 "No warning" is set.
- ◆ The following functions are possible when there is an error present:
 - ◆ VP, VC, VF
 - ◆ Quit
 - ◆ OUTPUT O0
 - ◆ GOTO data record indicator / password

START

Input I5

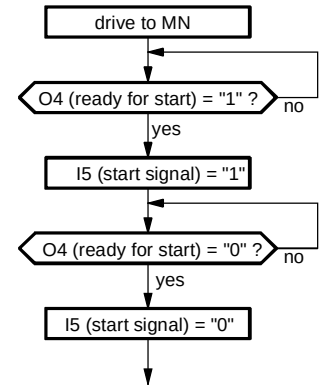


- Starts the program data record at WAIT START, once Power is on and after STOP.
- Performs the next data records (commands) before the next WAIT START command, an END instruction or a STOP or BREAK signal.
- O4 "Ready for start" is reset.

Note!

- Once a positioning process has been interrupted by STOP (I6="1"), the process can be continued, when START (I5="1") is present, using a descending flank at STOP (I6="0").

Temporal course of a start sequence:



STOP

Input I6



- The positioning process is interrupted using "1" and the axis is stopped in a controlled manner.
- O4 "Ready for start" and O6 "Idle after stop" = "1".
- You will require another start command if you are to complete the positioning process. When START is present, the resetting of the STOP signal is sufficient (I6="0").

Find MN

Input SHIFT I2



- Finds the machine zero point (when using reversing initiators: process velocity: P3 - the direction of the search can be determined using the P3 sign ; ramp time: P7).
- Once the MN is reached, output O3 "Machine zero approached" is set. This remains set until another "Find MN" order is issued.
- Output O5 "Programmed position reached" = "0".
- The data record indicator is reset to N001.
- Reference travel, prompted by the digital inputs, interrupts a positioning command specified by the interfaces (POSA, POSR, LOOP).

Approach RN

Input SHIFT I3



- The axis travels to the real zero point (process velocity: P4; ramp time: P8).
- O4 "Ready for start" = "0" until RN is reached.
- Output O5 "Programmed position reached" = "0", and once real zero is approached = "1".
- Data record indicator is reset to N001.
- In continuous mode, the axis does not move; the data record indicator is set to N001.

Teach in real zero (Teach Z)

Input SHIFT I4

- ◆ The present position of the axis is used as the reference point (real zero) for all positioning instructions; i.e. P1 is modified.
- ◆ The data record indicator is set to 1.
- ◆ The real zero is stored in a manner whereby it is safe should the power supply fail.
- ◆ O4 "Ready for start" is not modified.
- ◆ The teach in function can be switched off using P211.
- ◆ The function does not operate in continuous mode.

Input SHIFT I5

- ◆ When P211="3", the data record indicator is set to 1 using "Shift I5".

P211: blocking and modifying the teach in functions

P211	Function
= 0	The functions I1 + I4, Teach N, I1 + I5 and Teach Z are released.
=1	Teach Z is blocked; the data record indicator is set to 1 using I1 + I4 or "Teach Z".
=2	Teach N is blocked; the data record indicator is set to 1 using I1 + I5 or "TEACH N". (Teach Z is released)
=3	The functions Teach N and Teach Z are blocked. The data record indicator is set to 1 for I1 + I4, Teach N, I1 + I5 or Teach Z.

Break

Input SHIFT I6

- ◆ The positioning process is broken off, the axis is stopped.
- ◆ O4 "Ready for start" is set.
- ◆ The program data record is not ended after a start. The next data record applies.

EMERGENCY STOP

Mains power module connector X8/6 = 0V

- ◆ During an EMERGENCY STOP, the data record is interrupted, the drive brakes with braking time P10; after P10, the motor is switched off.
- ◆ The interrupted data record is continued to its completion after acknowledgment and START.

The descriptions are for transition points which trigger functions. All other transition points and status's do not trigger functions.

Triggering functions:

Function	I1	I2	I3	I4	I5	I6
Hand+ start	0		0	0	0	0
Hand+ end	X		X	X	X	0
Hand- start	0	0		0	0	0
Hand- end	X	X		X	X	0
QUIT	0	0	0		0	0
START	0	0	0	0		0
START	0	0	0	0	1	
STOP	0	X	X	X	X	1
Find MN	1		0	0	0	0
Approach RN	1	0		0	0	0
Teach - RN	1	0	0		0	0
SHIFT I5	1	0	0	0		0
BREAK	1	X	X	X	X	1

Activating position adjustment**Input I11** **Activating position adjustment**

- ◆ Function is switched on by P232="4" (also refer to page 105).
- ◆ I11="0": External position adjustment switched off (reaction time approx. 5 ms).
- ◆ I11="1": External position adjustment switched on.

Fast start**Input I15** **Special START input**

- ◆ Input for fast and defined starting of positioning process.
- ◆ The "Fast start" function is switched on using P18=2 or 3 (when using P18=3, the SPS data interface is also switched on).
- ◆ When I15="0", all positioning processes (POSA, POSR) are blocked.
- ◆ When I15="1", positioning processes are started. I15 has no influence during a positioning process.
- ◆ A positioning process which is interrupted with STOP is continued using START (I5="1") and "Fast START" (I15="1").
- ◆ The reaction time of I15 before the start of the positioning process is 1.5 ms.
- ◆ I15 has no effect in speed control mode.

➡ **Note!** The START signal (I5) is not replaced by I15; after STOP, a START signal (I5) is required to start the program and for WAIT START.

7.6.1.4 Synchronous STOP using I13

A stop FUNCTION can be implemented via I13 on standard devices (COMPAX XX00). This stop gives you the option of stopping several COMPAXs at the same time and bringing them to idle mode, regardless of the present speed.

Synchronous STOP:

P219=128 or 135 releases the synchronous stop via I13 (P219 bit 7²⁹=1).

I13="1": Normal mode

I13="0": Synchronous STOP is activated.

After I13="0"

- ◆ the drive is stopped using P10 as the **absolute ramp time** and
- ◆ using the ramp type selected via P94³⁰,
- ◆ error message E08 is output,
- ◆ O1 is set to 0 and
- ◆ the ready contact is opened.

For as long as I13=0, all additional attempts at positioning are negatively acknowledged using E08. No negative acknowledgment comes from HEDA.

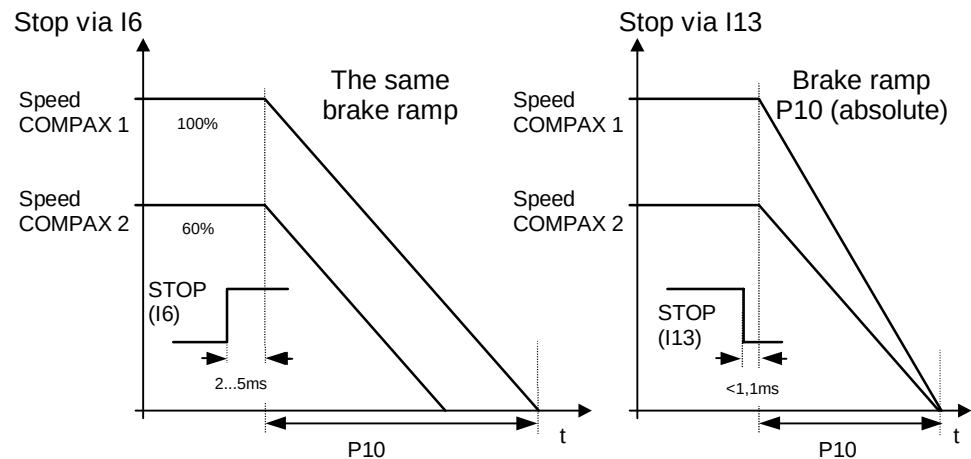
➡ Synchronous STOP function using I13 is only available on the standard unit (COMPAX XX00).

²⁹ Counting in bits beginning with bit 0.

³⁰ A modified ramp time is only used for the "Synchronous stop via E13" function after "VC".

Digital inputs and outputs

Diagram:



➡ When stopping using I13, the axes all come to standstill at the same time.

Note for MN travel:

If MN travel is interrupted by the synchronous stop, then O3 "Machine zero approached" is not released.

Additional assignment of P219:

P219 = xx000000=0: COMPAX-M does not evaluate the additional emergency stop input.

(Additional emergency stop input: X9/5-X9/6 (front plate); only in COMPAX-M)

P219 = xx000111=7: Emergency stop with P10 as relative ramp time, then switch off, message E56, display E56, output O1 = 0, ready contact removed.

Also effective in programming mode!

7.6.1.5 Function of outputs

No interruption

O1

- ◆ O1="1" if there is no error for group E1 ... E57.
- ◆ O1="0" there is an error for group E1 ... E57; the drive does not accept positioning commands.

No warning

O2

- ◆ O2="1" if there are no errors ³E58.
 - ◆ O2="0" if there is an error ³E58.
- O2 is assigned the "Idle display" function via P227 bit 1="1" (refer to page 91).

Machine zero has been approached

O3

- ◆ When "1" is displayed, this indicates that a reference system has been defined, i.e. there is information about the position of machine zero.
- ◆ When in "Normal mode", positioning is only possible when O3="1".
- ◆ By using an absolute value sensor and the relevant option (A1), O3="1" remains as such even if the unit has been switched off in the meantime.
- ◆ Once the "Find machine zero" function has been activated (I1&I2="1"), O3="0" until machine zero is found.

Ready for start

O4

- ◆ "Ready for START" is used for program control.
- ◆ O4 is set,
- ◆ if the program is at a WAIT START instruction and waiting for the START signal,
- ◆ after an interruption with STOP or BREAK and these signals are no longer present,
- ◆ after a corrected error condition and
- ◆ after Power On.
- ◆ at program end with the END command.
- ◆ O4 has no significance as a direct command specification.

Position reached

O5

- ◆ O5 is set to "0" when starting a positioning process; this applies for POSA, POSR, WAIT POSA, WAIT POSR, approach real zero, approach machine zero, Hand+, Hand-.
- ◆ O5 is set once the positioning has been completed in the correct manner. This applies for POSA, POSR, WAIT POSA, WAIT POSR, Approach real zero. POSR 0 causes the brief resetting of O5.
- ◆ Conditions for O5="1":
- ◆ The actual position value is in the positioning window (+/-P14) and

- ◆ the nominal value sensor has reached the target point of the nominal value specification.
- ◆ O5 is set in speed control mode, if the nominal value generator has processed the speed ramp.

Idle after stop or break

O6

- ◆ O6="1" indicates that the axis is at a standstill due to a STOP (I6) or BREAK (I1&I6).
- ◆ O6 is reset if the axis moves again.

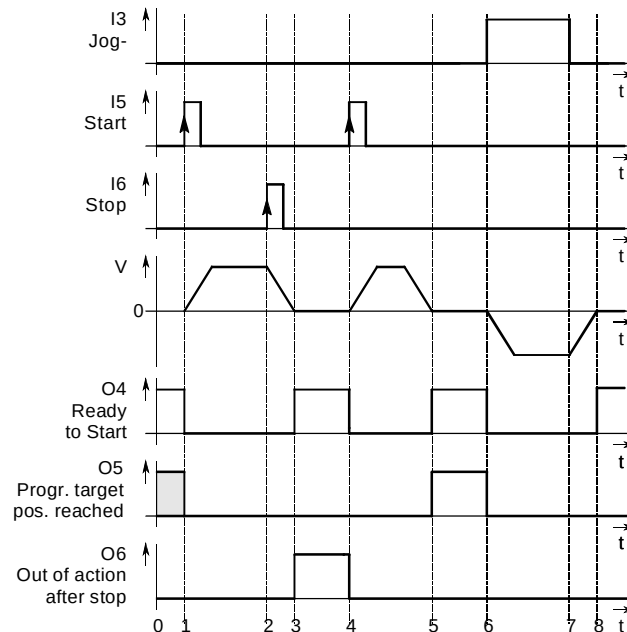
Mark missing after maximum feed length

O16

- ◆ Only assigned if mark reference is activated (P35=1).
- ◆ For "0", the mark is missing once the maximum feed length has been reached (refer to page 75).

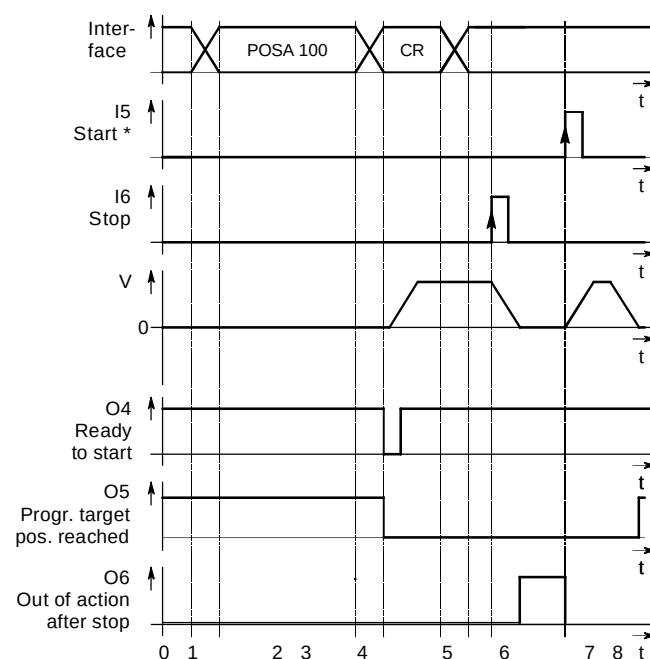
7.6.1.6 Diagrams

In data record memory mode



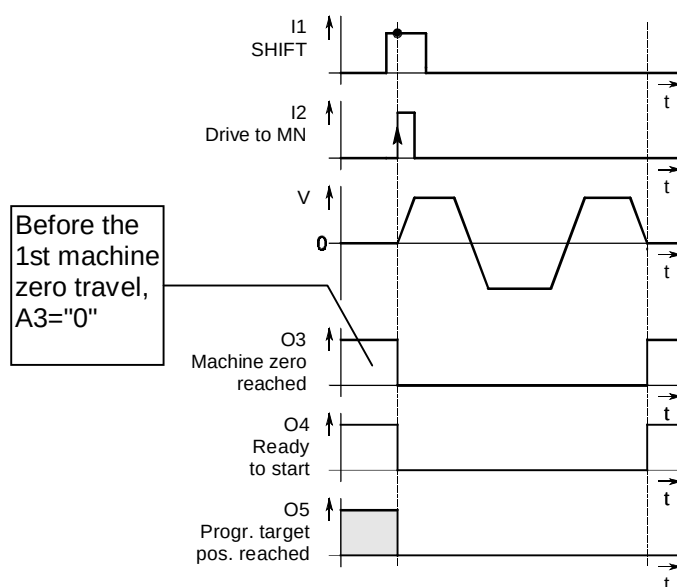
- Key:**
- 0 COMPAX is ready for new start.
 - 1 When using START at input I5, the outputs O4 and O5 are reset. The axis moves.
 - 2 Interruption using STOP at input I6. After idle, message at output O6 (3).
 - 4 START using I5. Positioning process is continued.
 - 5 Positioning process ended. Message via O4 and O5="1".
 - 6 Manual processing of axis. O5 and O4 ="0".
 - 7 Specification for manual processing ended. Drive decelerates.
 - 8 Manual process ended. Drive at standstill. Ready message for output O4 is set.

Direct command specification

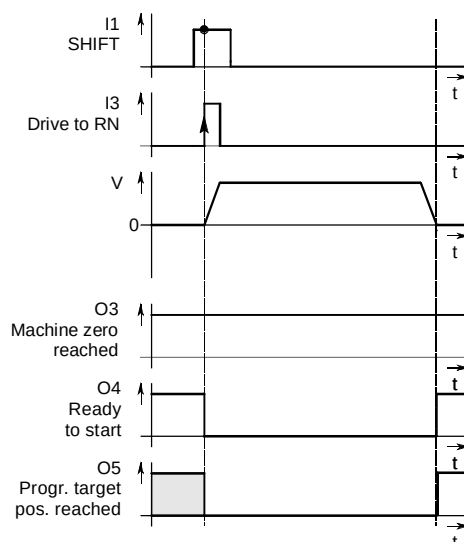


* When using this START, a processing command, which has been interrupted by STOP and specified by a interface, is restarted.

Finding machine zero in normal mode



Approaching real zero



7.6.2 SPS data interface

This universal data interface allows data to be exchanged with all SPS types, regardless of who manufactured them and which country they are located in. You will need five binary inputs and outputs for this process. These can be divided into four data lines (BCD format) and one control line.

Functions available:

- ◆ Direct commands
- ◆ Absolute and relative positioning commands (POSA, POSR)
- ◆ Specification of acceleration time and velocity (ACCEL, SPEED)
- ◆ Adjusting password approval or data record indicator (GOTO)
- ◆ Queries of status S1...S12 (actual values).
- ◆ Modifying the parameters P1...P49 with defined parameter transfer (VP).

Activating:

The SPS data interface is activated by setting P18 (P18="1" or "3". When it is "3", the "Fast start" function I15 is also switched on) and by switching off and on. The following binary inputs and outputs are assigned:

Input/output	Meaning
I7 (X8/7)	Control line "UBN"
I8 (X8/8)	Data bit 2 ⁰
I9 (X10/1)	Data bit 2 ¹
I10 (X10/2)	Data bit 2 ²
I11 (X10/3)	Data bit 2 ³
O7 (X8/15)	Control line "RDY"
O8 (X8/16)	Data bit 2 ⁰
O9 (X10/9)	Data bit 2 ¹
O10 (X10/10)	Data bit 2 ²
O11 (X10/11)	Data bit 2 ³

➡ O7...O11 are no longer available for the OUTPUT command. The GOSUB EXT and GOTO EXT commands are no longer permitted when P18="1". Instead use the GOTO command.

Each transfer begins with the start letter "E" and ends with the end letter "F". In between them is the command. This consists of two BCD numbers (called function code) for the mode type and of numerical values for position, velocity, acceleration time, etc. The numerical values can contain special figures:

Figure BCD encoded	Meaning
"D" ≡ "1101"	negative prefix
"0" ≡ "0000"	positive prefix
"C" ≡ "1100"	decimal point
"A" ≡ "1010"	assignment "="

➡ Using status S29, you can e.g. track the interface data via the front plate display.

Syntax of the individual commands:

Positioning
commands POSA,
POSR

Start sign	"E" ≡ "1110"
Function code 1:	"0" ≡ "0000"
Function code 2:	"1" ≡ "0001": POSA "2" ≡ "0010": POSR
Prefix	"0" ≡ "0000": positive "D" ≡ "1101": negative
Numerical value	10 ⁶
Numerical value	10 ⁵
Numerical value	10 ⁴
Numerical value	10 ³
Numerical value	10 ²
Numerical value	10 ¹
Numerical value	10 ⁰
Decimal point	"C" ≡ "1100"
Numerical value	10 ⁻¹
Numerical value	10 ⁻²
Numerical value	10 ⁻³
End sign	"F" ≡ "1111"

Velocity
specification
SPEED

Start sign	"E" ≡ "1110"
Function code 1:	"0" ≡ "0000"
Function code 2:	"4" ≡ "0100"
Prefix	"0" ≡ "0000": positive "D" ≡ "1101": negative
Numerical value	10 ¹
Numerical value	10 ⁰
Decimal point	"C" ≡ "1100"
Numerical value	10 ⁻¹
Numerical value	10 ⁻²
Numerical value	10 ⁻³
End sign	"F" ≡ "1111"

Acceleration time
ACCEL

Start sign	"E" ≡ "1110"
Function code 1:	"0" ≡ "0000"
Function code 2:	"5" ≡ "0101"
Prefix	"0" ≡ "0000": positive "D" ≡ "1101": negative
Numerical value	10 ⁴
Numerical value	10 ³
Numerical value	10 ²
Numerical value	10 ¹
Numerical value	10 ⁰
End sign	"F" ≡ "1111"

Adjusting data
record indicator /
approving
password: GOTO

Start sign	"E" ≡ "1110"
Function code 1:	"0" ≡ "0000"
Function code 2:	"6" ≡ "0110"
Numerical value	10 ²
Numerical value	10 ¹
Numerical value	10 ⁰
End sign	"F" ≡ "1111"

Modifying the parameters P1...P49

Start sign	"E" ≡ "1110"
Function code 1:	"1" ≡ "0001"
Function code 2:	"3" ≡ "0011"
Parameter no. tens column	
Parameter no. digits column	
Assignment code:	"A" ≡ "1010"
Prefix	"0" ≡ "0000": positive "D" ≡ "1101": negative
Numerical value 10 ⁶	
Numerical value 10 ⁵	
Numerical value 10 ⁴	
Numerical value 10 ³	
Numerical value 10 ²	
Numerical value 10 ¹	
Numerical value 10 ⁰	
Decimal point	"C" ≡ "1100"
Numerical value 10 ⁻¹	
Numerical value 10 ⁻²	
End sign	"F" ≡ "1111"

Transfer of VP parameter

Start sign	"E" ≡ "1110"
Function code 1:	"1" ≡ "0001"
Function code 2:	"4" ≡ "0100"
End sign	"F" ≡ "1111"

Status query S1...S12 (actual values)

Start sign	"E" ≡ "1110"
Function code 1:	"1" ≡ "0001"
Function code 2:	"6" ≡ "0110"
Numerical value 10 ¹	
Numerical value 10 ⁰	
End sign	"F" ≡ "1111"

Status response S1...S12 (actual values)

Start sign	"E" ≡ "1110"
Prefix	"0" ≡ "0000": positive "D" ≡ "1101": negative
Numerical value 10 ⁶	
Numerical value 10 ⁵	
Numerical value 10 ⁴	
Numerical value 10 ³	
Numerical value 10 ²	
Numerical value 10 ¹	
Numerical value 10 ⁰	
Decimal point	"C" ≡ "1100"
Numerical value 10 ⁻¹	
Numerical value 10 ⁻²	
Numerical value 10 ⁻³	
End sign	"F" ≡ "1111"

The following signs are not necessary when transferring:

- ◆ Positive prefixes and initial zeros.
- ◆ For whole number values: the decimal point and the figures after the decimal point.

Function codes of commands

Function code BCD encoded		Command
F-code1	F-code2	
0	1	POSA
0	2	POSR
0	4	SPEED
0	5	ACCEL
0	6	GOTO
1	3	Modify parameters (P1-P49)
1	4	VP (valid parameter)
1	6	Query status (S1-S12)

Procedure for transmitting a sign

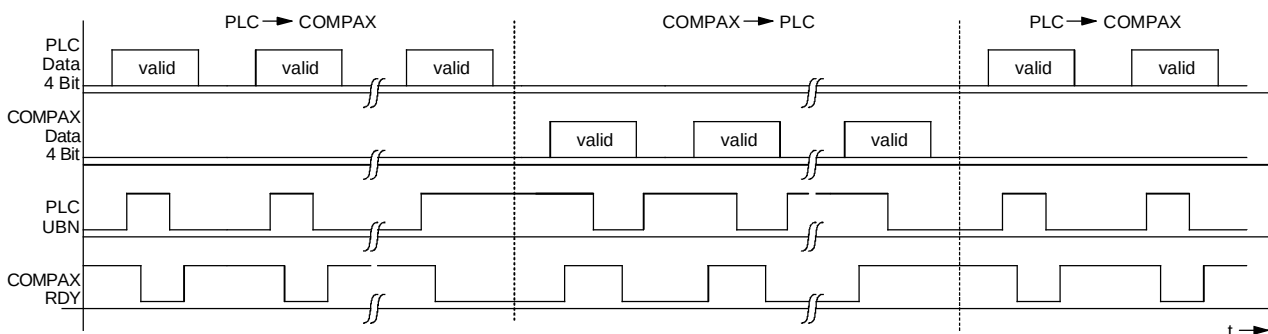
- ◆ SPS assigns the sign (4 bit) to I8...I11.
- ◆ Once the data is stable, the SPS sets the UBN to "1".
- ◆ COMPAX reads the sign and sets RDY to "0".
- ◆ SPS sets UBN to "0".
- ◆ COMPAX sets RDY to high.

Exception: If the data direction is then reversed, COMPAX can set the RDY line to "0". This is the case for the last sign of a status query.

Process for receiving a sign

- ◆ SPS sets UBN to "1".
- ◆ COMPAX assigns the sign (4 bit) to O8...O11.
- ◆ COMPAX sets RDY to "1"
- ◆ SPS reads the sign and sets UBN to "0".
- ◆ COMPAX sets RDY to "0".

Exception: If the data direction is then reversed, COMPAX can set the RDY line to "1". This is the case for the last sign of a status response.

Signal procedure using the example of a status query

➡ It is important that the data ready message in question is only assigned after the data (when using SPS, one cycle later); i.e. once the data has been safely assigned.

Resetting interface

If interruptions have caused the signal "RDY" to not be in place, the interface can be reset to its initial status using signal "E" (start sign). The next "UBN" is then detected despite the fact that there is not a "RDY".

7.6.3 RS232 interface

You can communicate with COMPAX via an RS232 interface on a PC. The following functions are available.

- ◆ Direct command input and performance in on-line mode.
- ◆ Reading the status values.
- ◆ Reading and describing the program data records (in such instances the complete stock of commands is available).
- ◆ Reading and describing (password protected) parameters.
- ◆ Transmitting control instructions.

7.6.3.1 Interface description

Interface parameters

Interface	RS232
Baud rate:	9600* or 4800 (can be selected using P19)
Word length:	8 Bit
Stop bit:	1
Parity:	none
Hardware handshake:	yes (RTS,CTS)
Software handshake:	XON, XOFF (can be selected using P20)
Entry buffer:	an error string of max. 30 characters
Output buffer:	a status string of max. 30 characters
Data format:	ASCII
End sign:	C _R (carriage return) or C _R L _F (carriage return, line feed)

* Standard setting; by simultaneously pressing the three front plate buttons while switching on, you can set COMPAX to 9600 Baud.

COMPAX receives

- ◆ all ASCII characters which can be displayed
 - ◆ any spaces inserted
 - ◆ a function sign, if nec. (\$, ?, !)
 - ◆ C_R (carriage return) for storing the command in the intermediate memory. If no function signs have been transmitted, the command is transferred and performed, if necessary (refer to the next page).
 - ◆ L_F (line feed) has no meaning to COMPAX
- ➡ COMPAX only receives a command, if a command was previously transmitted using C_R L_F > and a response was given.

COMPAX replies

- ◆ if the syntax is perfect, and does so using C_R L_F > or using the desired response and C_R L_F >
- ◆ if there are errors, depending on the contents of P20

Meaning of the function signs

\$	Automatic "position reached" message ◆ only applies to POSA and POSR ◆ COMPAX transmits: \$C_RL_F> when the position is reached.
'	Interpreting and storing commands COMPAX stores the instruction in the intermediate memory (size: can hold one instruction) without performing it.
?	Echo COMPAX returns the data received with C _R L _F >.
!	Performing commands Whenever a "!" occurs, the instruction is performed from the intermediate memory.

These function signs can be attached to any instruction.

Example: POSA 100 \$ C_R L_F

COMPAX moves and responds once position 100 is reached using: \$ C_R L_F >

P20: Software handshake (SH) / error transmission

Function	Activation using P20	Valid as of
Software handshake	"0": without "1": with XON, XOFF	Power on
Error transmission	"0": Error only when there is activity at the interface and if the transmitted command triggers an error. No negative command acknowledgement (E90 ...E94). "2": No transmission of the error and no negative command acknowledgments (E90 ...E94). "4": Messages are provided for all errors and negative command acknowledgments (E90 ...E94) as soon as they arise and this is done with Exx C _R L _F >. "6": Error and negative command acknowledgement (E90 ...E94) only when there is activity at the interface.	immediately
End sign selection	"0": C _R L _F > "8": C _R	Power on
Binary transfer	"0": without "16": with	immediately
BCC: Block check	"0": without "128": with (EXOR via all signs apart from the end sign)	Power on



Perform the setting you want by entering the sum of the set values in P20.

Example in Quick-Basic of how to transmit and receive COMPAX data via the RS232 interface.

<pre> DIM text\$(30) a\$="com1:9600,N,8,1" OPEN a\$ for RANDOM AS #1 text\$="S1" PRINT #1,text\$ text\$="" INPUT #1, text\$ PRINT text\$ END </pre>	- ˆ The text string "text\$" is defined and has a length of 30. - ˆ The interface parameters are assigned to the "a\$" string. Meaning: - ˆ com1: the com1 serial interface is used. - ˆ 9600: sets Baud rate to 9600 - ˆ N: no parity - ˆ 8: 8 bit word length - ˆ 1: one stop bit - ˆ The interface is initialized and marked with #1 (channel 0). - ˆ Status S1 should be queried. - ˆ text\$ is output on channel 1. - ˆ text\$ is deleted so that the response can be accepted. - ˆ S1 is read by channel 1 in text\$ - ˆ S1 is output on the screen
--	---

7.6.3.2 Interface functions

Direct command entry

When making direct command entries via RS232, you can use the abbreviated form for most instructions (two letters).

Commands permitted for the various modes of operation

Refer to table on page 129!

➡ When using "Direct command entry", write an "END" instruction in natural language memory no. 1 because the start command refers to the program memory if the unit contains no direct commands.

Preparatory positioning commands		
◆ These commands can be transmitted to COMPAX when idle and during a positioning process. ◆ The commands are transferred with the next positioning command		
Instruction	Abbreviated form	Meaning
ACCEL	AL	Accelerating and braking time in ms
ACCEL-	AL-	Separate specification of braking time.
SPEED	SD	Velocity in %
POSR <i>value1</i> SPEED <i>value2</i>	PR SD	Preparation for speed step profiling.
POSR <i>value1</i> OUTPUT <i>Axx=y</i>	PR OT	Sets comparator function. The comparators are also reported using "C _{RLF} > comparator no." via RS232 (refer to Example 2).

Example 1: POSR 100 SPEED 50 C_R L_F or
PR 100 SD 50 C_R L_F
Prepares a speed step.

Example 2: PR 200 OT O9=1 1st comparator
PR 100 OT O10=1 2nd comparator
POSA1000\$
The following signs are returned:

- ◆ 2 C_{RLF} > after 100 units
- ◆ 1 C_{RLF} > after 200 units
- ◆ \$ C_{RLF} > after 1000 units

Positioning commands

- ◆ Positioning commands can be transmitted to COMPAX when idle and during a positioning process.
- ◆ If the axis is moving, the command is acknowledged negatively.
- ◆ The present setting (ACCEL, SPEED, ...) applies to the positioning command; i.e. these settings can still be modified before the positioning command is transmitted.
- ◆ A positioning command specified by the interfaces is interrupted by a reference journey prompted by the digital inputs. (POSA, POSR, LOOP).

Instruction	Abbreviated form	Meaning
POSA	PA	Absolute position
POSA HOME	PH	Find machine zero
POSR	PR	Relative position
OUTPUT O0	OT O0	Switches off drive

Example 1: POSA or PA 2500C_RL_F
 2500C_RL_F
 Proceeds to position 2500

Influencing the active positioning process

- ➡ This command is only permitted provided that COMPAX has not received any more commands since the positioning command currently being processed (the exceptions to this being commands which are not position dependent, such as OUTPUT, GOTO and ACCEL, ACCEL-).
- ◆ Directly modifies the velocity of an active positioning process.
 - ◆ The type of speed transfer and the ensuing braking ramp can be influenced by previously modified acceleration times (ACCEL, ACCEL-).

Instruction	Abbreviated form	Meaning
POSR 0 SPEED value	PR 0 SD	Direct speed modification.

Commands which are not position-dependent

- ◆ These commands are processed regardless of a positioning process specified by the interface (not during an internal data record procedure).

Instruction	Abbreviated form	Meaning
OUTPUT	OT	Sets output
GOTO	GO	Adjusts data record indicator and/or approves / blocks password.

Commands which are only permitted when drive is idle

- ◆ The axis must be at a standstill if modified VP parameters are to be transferred.
- ◆ The axis must be switched off if modified VP parameters are to be transferred (e.g. via OUTPUT O0=1).

Instruction	Abbreviated form	Meaning
VALID PARAMETER	VP	Modified parameter transferred (not the configuration parameter).
VALID CONFIGURATION	VC	All parameters are transferred using VC.

Reading the status values

You can use the serial interface to query all status values, even during a positioning process.

- ◆ Sxx transmitting, xx = number of the status value.
- ◆ COMPAX returns the present value.

Example: S1 C_R L_F
 Respos S001:xxxxxxxx,xxxmm C_R L_F
 e: >

➡ The decimal point for S1 - S12 is always the ninth digit after the ":".

7.6.3.3 Reading and describing program sets and parameters

➡ Even possible during a positioning process.

Download:
describing the
sets and
parameters

Instruction	Meaning
Nxxx: <i>instruction</i>	Describes set xxx with <i>instruction</i> .
Pxxx=<i>value</i>	Describes parameter xxx with <i>value</i> .
Pxxx="<i>name</i>" (Only for P40-P49)	Provides parameter xxx with <i>name</i> .

Example: N005: POSA 100 C_R L_F or N005: PA 100 C_R L_F
The POSA 100 instruction is written in data record 5.

Upload: reading
the sets and
parameter

Instruction	Meaning
Nxxx	Reads data record xxx.
Pxxx	Reads parameter xxx.

Example: P40 C_R L_F
COMPAX transmits the contents of P40: P40=*value name* C_R L_F>

**Transmitting
control
instructions**

Instruction	Abbreviated form	Meaning
START Nxxx	SNxxx	Performs program set xxx (only this set).
START	ST	Starts program.
STOP	SP	Stops program/positioning. SP corresponds to a STOP pulse
QUIT	QT	Acknowledges error.
TEACH Z	TZ	Transfers current position as real zero point. (P1 is modified). The set indicator is set to 1.
TEACH Nxxx	TNxxx	Present position is written into set xxx using POSA command. Not possible in "Reset mode".
BREAK	BK	Interrupts positioning or program step.

Example: START N010 C_R L_F or SN 010 C_R L_F
Set 10 is performed

**P211:Blocking
and modifying the
teach in functions**

P211	Function
= 0	The functions I1 + I4, Teach N, I1 + I5 and Teach Z are approved.
=1	Teach Z is blocked; the set indicator is set to 1 using I1 + I4 or "Teach Z".
=2	Teach N is blocked; the set indicator is set to 1 using I1 + I5 or "TEACH N". (Teach Z is approved)
=3	The functions Teach N and Teach Z are blocked. The set indicator is set to 1 using I1 + I4, Teach N, I1 + I5 or Teach Z.

Negative command acknowledgement

If commands are issued using RS232 and they cannot be performed (invalid commands, if the password is not specified or if COMPAX is busy), a warning is sent back. Meaning:

E90	Syntax error; command invalid
E91	Command cannot be performed in this COMPAX operating mode.
E92	Function running, command cannot be performed
E93	Set memory active, command cannot be performed
E94	Password not specified

These warnings are not entered in status S18 (error history).

Authorization of commands in different modes of operation

Operating status	Commands available
Commands available in all operating modes / status's	◆ Status query (Sxx) ◆ Parameter query and parameter assignment (Pxxx, Pxxx=value) ◆ Set query and data record assignment (Nxxx, Nxxx=value) ◆ Set / reset outputs (OUTPUT Ax=y); Not OUTPUT O0!
◆ Stop ◆ Emergency stop ◆ OFF (motor switched off) ◆ Error present	◆ VP, VC, VF ◆ Quit ◆ OUTPUT O0 ◆ GOTO data record indicator / password
◆ When in data record mode	◆ VP
◆ During a positioning process (as preparation for the next command)  No program processing.	◆ VP ◆ SPEED³¹ / ACCEL ◆ POSR value SPEED value / POSR value OUTPUT Ax=y ◆ GOTO data record indicator / password
◆ Find machine zero ◆ Approach real null ◆ Hand +/-	No other commands are available.
◆ During RUN (motor under torque)  No positioning.  No stops present.  No errors present.	All commands and functions are available.

³¹ SPEED is not available here in speed control mode.

7.6.3.4 Binary data transfer using RS232

A series of commands can be transferred in the COMPAX internal binary format for applications for which time is critical. This saves times as the format no longer needs to be changed from ASCII into the COMPAX internal binary format. You can however still transfer data in the normal ASCII format (mixed mode).

P20: switching on binary data transfer

$$P20 = P20 + 16$$

Adds 16 to the P20 setting that you want (refer to the interface parameters section in the User Guide). This ensures that binary data transfer is available in addition to normal transfer (ASCII).

Example:

P20="3": with XON, XOFF; no error response message; without binary data transfer.

P20="19": with XON, XOFF; no error response message; with binary data transfer.



- ◆ **The end sign must not be transmitted.**
- ◆ **The entire length of the binary format must always be transferred.**
- ◆ **Function signs (" \$" " " " ? " " ! ") are not available when using binary transfer.**

COMPAX response

the same as that for ASCII transfer:

- ◆ without errors: using "CR LF >".
- ◆ with errors: depending on the value of P20
(refer to "Error transmission" in the User Guide).

Meanings of the binary command codes

Command	Binary format (hexadecimal)
POSA value	88 41 xx xx xx xx xx xx LSB MSB
POSR value	88 52 xx xx xx xx xx xx LSB MSB
SPEED value	88 53 xx xx xx xx xx xx LSB MSB
ACCEL value	84 4C yy yy MSB LSB
ACCEL- value	84 44 yy yy MSB LSB
OUTPUT Ayy=0	85 4F yy yy 30 MSB LSB
OUTPUT Ayy=1	85 4F yy yy 31 MSB LSB
POSR value OUTPUT Ayy=0	8C 52 xx xx xx xx xx xx 4F yy yy 30 LSB MSB MSB LSB
POSR value OUTPUT Ayy=1	8C 52 xx xx xx xx xx xx 4F yy yy 31 LSB MSB MSB LSB
POSR value1 SPEED value2	8F 52 xx xx xx xx xx xx 53 xx xx xx xx xx xx LSB MSB LSB MSB

Numerical formats

Numerical formats of "xx xx xx xx xx xx" *2

3 bytes after the decimal point, 3 bytes before the decimal point.

Valency:

 $2^{-24} \ 2^{-23} \ \dots \ 2^{-2} \ 2^{-1} \ \cdot \ 2^0 \ 2^1 \ 2^2 \ \dots \ 2^{22} \ 2^{23}$

Transmission sequence e. g.: "88 41 LSB....MSB"

Numerical formats of "yy yy"

2 bytes before the decimal point.

no digits after the decimal point.

Valency: *¹
$$2^{15} 2^{14} \dots 2^2 2^1 2^0.$$

Transmission sequence e.g.: "84 4C MSB LSB".

***¹ Negative numbers**

Negative numbers are represented in binary complement format. Creating the binary complement format.

- ◆ Determine the bit combination of the positive numerical value.
- ◆ Negate the binary value.
- ◆ Add 1.

***² Format change**

You can generate this format from any number (as long as it has digits after the decimal place) as follows.

Example

Number = 450.5

1. Multiply number by 2^{24} .
 $450.5 \times 2^{24} = 7\,558\,135\,808$.
2. Change 7 558 135 808 into a hexadecimal number (if nec., first into an integer)
 $\Rightarrow 0x00\,01\,C2\,80\,00\,00 \equiv$ before the decimal point, after the decimal point $\equiv$ MSB,... LSB, MSB,... LSB.
3. These bytes must now be entered into the commands in the sequence specified. The sequence of the bytes is reversed. Do not alter the sequence of the bits.

This conversion also applies to negative numbers.

Examples of the number format of "xx xx xx xx xx xx"

Number	MSB			LSB		
10	00	00	0A	00	00	00
360	00	01	68	00	00	00
450.5	00	01	C2	80	00	00
-1	FF	FF	FF	00	00	00
	whole numbers			decimal places		

In this way, you will attain the following string e.g. for POSA 360.0:

"88 41 00 00 00 68 01 00"

Attention: transfer all digits.

**Starting up during
binary transfer**

Note: when binary transfer is switched on, note the following.

- ◆ Only create RS232 connection when participants are switched on or
- ◆ when participants are switched off, the RS232 is initialized again by COMPAX using Power on.

7.6.4 Process coupling via HEDA (option A1 / A3)

Synchronization and fast start via HEDA:

HEDA (SSI interface) can be used to initiate synchronization of several axes. The accuracy of the synchronization is ± 2.5 microns of the individual controller timer discs.

The master (operating mode 1) transmits 2 synchronization words to the slave axes, enabling them to synchronize. The slave axes (operating mode 2) control their own synchronicity. No response is transmitted from the slave axes to the master.

The master only transmits to axis address 1. Therefore, all slaves must also be set to address 1 (P250=1).

➡ Acyclic communication between master and slave is not possible.

Variants support:

COMPAX XX00 as slave to transmit the "Fast start" or as master

COMPAX XX60 as master or slave not when P212=3 and P212=4

COMPAX XX70 as master or slave only when P31=9

Physical limits:

Max. 16 participants in the master/passive slave operating mode and max. 50m cable length.

Hardware requirements:

The units must be fitted with the A1 / A3 option. There must be a terminating connector bus 2/01 on the last slave.

HEDA parameters:

Parameter no.	Meaning	When valid	Default value
P243	HEDA operating mode	VP	0
P245*	Assigns the outputs O1 ... O8 to a HEDA bus	immediately	0
P246*	Assigns the outputs O9 ... O16 to a HEDA bus	immediately	0
P247	Max. average transmission error	VP	5
P248	Max. transmission error	VP	15
P249	Synchronization monitoring	VP	10
P250	Unit addresses (in master – slave mode =1)	VP	0

*In the HEDA master - HEDA slave operating mode (passive slave to COMPAX master), P245=P246=0 is set.

Operating modes:

No.	P243	P250	Operating mode	Description
0	Not relevant	= 0	Independent single axis	No coupling, no synchronization
0	0	= 1 ... 9	Slave to IPM on HEDA	Coupled operation and acyclic communication over HEDA possible
1	Bit 0="1" (P243=1)	= 1	COMPAX as Master	Master axis transmits synchronous word and 7 words to address 1
2	Bit 1="1" (P243=2)	= 1	Passive slave to COMPAX master	Slave receives at address 1 (P250=1), but does not send back

➡ Attention!

If HEDA coupling is activated and the master performs "Find machine zero", this will result in a positional offset between master and slave.

You should therefore, perform the machine zero travel when the HEDA coupling is deactivated.

Fast start

P18 has the following bits added:

P18	Meaning
Bit 0	=0 without SPS data interface =1 with SPS data interface
Bit 1	=0 fast start on I15 not active =1 fast start on I15 active
Bit 2	reserved
Bit 3	=0 fast start on HEDA bit 8 not active =1 fast start on HEDA bit 8 active only permitted when P18: bit 1=1 (see below).

Reference: The fast start has for master and slave an additional delay time of 1ms; the whole delay time amount 2,5ms.

The fast start is synchronized using P18 bit 3 for HEDA with master and slave, i.e. not only must input 15 be on the slave but the master fast start (triggered by I15 for master) must also be on HEDA so that it can be performed.

This operating mode is also set with **P18=10**.

If I15 is not required on the slave, then set I15="1".



Operation is not permitted if P18=8.

Transmittable parameters:

The master transmits one data block per ms to address 1, consisting of

- ♦ HEDA control word incl. fast start in response to bit 8 (Bit 8 is automatically generated from I15 "fast start").
- ♦ process value, selected with parameter P184 depending on family (COMPAX XX00, COMPAX XX60, COMPAX XX70) between:

Master output parameters:

Output parameters	Master
• Encoder position (COMPAX XX70) + master channel duration period	P184=40
• Internal time base / encoder velocity before P35* (COMPAX XX70)	P184 = 42
• Normalized master position before P35* (COMPAX XX70)	P184 = 43
• Nominal position value in resolver increments [65536 increments/revolution]	P184 = 44
• Actual position value in resolver increments [65536 increments/revolution]	P184 = 45
• Differentiated resolver position [increments/ms]	P184 = 46

* The parameter is unaffected by P35.

Slave input parameters:

Coupling the slave to the transmitted parameter is done using P188.

Input parameters	Slave
• Encoder coupling (P184 in master =40) The input signal is used as an encoder signal.	P188=40
• Internal time base / encoder velocity before P35* (COMPAX XX70) The input signal is used as a master velocity. Application: coupling several axes to one master signal (e.g. an internal time base)	P188 = 42
• Normalized master position before P35* (COMPAX XX70) The input signal is used as a master position. Application: coupling several axes to one master signal (e.g. an internal time base)	P188 = 43
• Input parameter is interpreted as an encoder signal even though it is not an encoder signal (P184 in master ≠ 40) see below for more information.	P188=140

* The parameter can be influenced by P35.

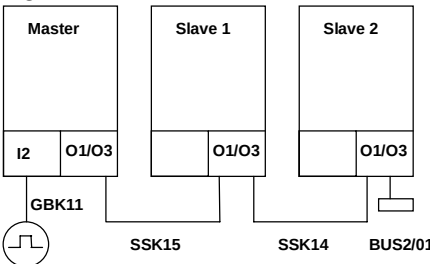
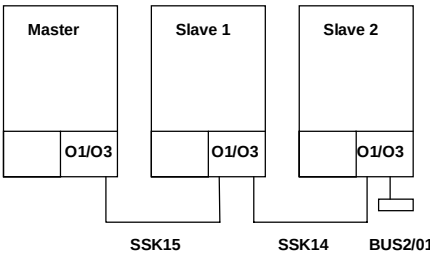
Permissible combinations and the required parameter settings:

Master output parameters: P184=	Slave input parameters: P188=	Can be used in slave unit versions:	Settings in master and slave for adapting the process parameters: P98 is identical in all units,
40 (CPX 00 CPX 60, CPX 70)	40	CPX 60, CPX 70	P143 _S =P143 _M ³²
	43	CPX 70	
42 (CPX 70)	42	CPX 70	P143 _S =P143 _M
43 (CPX 70)	140* 43	CPX 60, CPX 70 CPX 70	P143 _S =P143 _M
44 (CPX 00 CPX 60, CPX 70)	140* 43	CPX 60, CPX 70 CPX 70	P143 _S = 2 ¹⁴ = 16384
45 (CPX 00 CPX 60, CPX 70)	140* 43	CPX 60, CPX 70 CPX 70	P143 _S = 2 ¹⁴ = 16384
46 (CPX 00 CPX 60, CPX 70)	42	CPX 70	P143 _S =P143 _M

* When the encoder position P184=40 is transferred, the encoder position is transferred into high word and the duration period of the pulses is transferred into low word to support a duration period measurement in the slave.

If a mixture of usage purposes is undertaken, e.g. master P184=44 (nominal value) and slave with encoder coupling, then the slave must be notified of this using P188=140 (in such instances, only the high word is processed).

Application examples:

	1st unit: master	Slave
Coupling of several axes to one encoder; using HEDA to distribute the signals 	COMPAX XX60 COMPAX XX70 (P31=1) Encoder input P184=40 (encoder position+duration period) P188 = 40	COMPAX XX60 COMPAX XX70 (P31=9) P188=40 (Encoder input; duration period available)
Replacing the encoder emulation using HEDA bus  Reference: There is a delay time of 2ms between Master and Slave. Way out: work with "fast start" and the same program.	COMPAX XX00 COMPAX XX60 COMPAX XX70 P184=44 (nominal position value) or P184=45 (actual position value) P188 = 0	COMPAX XX60 COMPAX XX70 P188 = 140 Setting: P143 = 16384 (¼ of the increments are always in P143 since a quadrupling occurs during encoder inputs)
Coupling of several curve discs with the same time base and separate master or slave oriented label synchronization (see above)	COMPAX XX70 P184=42 (time base) P188 = 42	COMPAX XX70 P188=42 P143 _S =P143 _M
Linking of several curve discs with the same time base and absolute zero drift between the axes due to the transfer of a position value (see above)	COMPAX XX70 P184=43 (normalized master position) P188 = 43	COMPAX XX70 P188=43 P143 _S =P143 _M

³² P143_S: parameter P143 of the slave
P143_M: parameter P143 of the master

Error handling

Only position signals can be completely restored following HEDA transmission errors. When transmitting velocities, transmission errors can lead to drift tendencies between the axis positions. **For this reason use of the position values is preferred.**

Error messages:

HEDA transmission or synchronization errors are errors E76, E77 and E78 (see the Error list in the User Guide).

E76: Synchronization is interrupted with E76, therefore an alignment is implemented whereby the process position value is aligned in such a manner that a position leap does not occur.

E77/E78: With E77/E78, the slave attempts to reach the new undisturbed process position value in order to maintain the reference system.

**Attention!**

Transmitting "VC" interrupts the synchronization. Only activate "VC" when the unit is switched off. When working with the user terminal BDF2, "VC" is transmitted when the "Parameter edit" menu is exited.

Transmission error procedure:

Position values / position (P184=40/43/44/45): linear interpolation using old values
Velocity values / frequencies (P184=42/46): keeps old value

Synchronizing process values:

In instances when P188>0 on the master side, a specified delay of the associated process value is implemented and amounts to a total of 2 ms. This ensures that the master waits until all axes have received the process value. This in turn ensures that all axes, including the master, continue to process the new nominal values at the same time.

- Note:**
- ◆ No other I/Os are transferred apart from the fast start.
 - ◆ There can be only one master on the bus.

- Note:**
- ◆ The position values for P184=44 and P184=45 are derived regardless of the present positioning operating mode (normal, continuous, reset). They are attained from the nominal position value and the actual position value and made available unsolicited in 24-bit format, just as if one were dealing with counter channels. This avoids jerky changes in the starting torque (in continuous mode) or when reading the end of the curve (in reset mode). Only the lower 24 bits of these values are transmitted, consisting of the resolver value and maximum 256 motor revolutions.

You will find the cable types required on page 41.

8. Accessories and options

C o m p a c t s e r v o c o n t r o l

8.1 System concept

The COMPAX system concept is based on a basic unit which contains the important function components and other system components. You can use these to extend a system to meet your specific requirements.

The system consists of the following components:

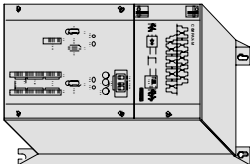
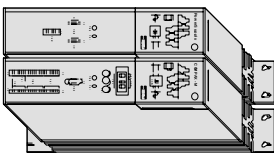
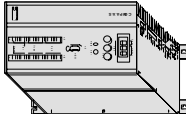
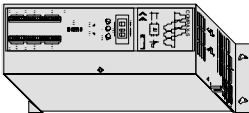
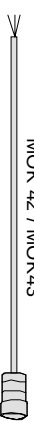
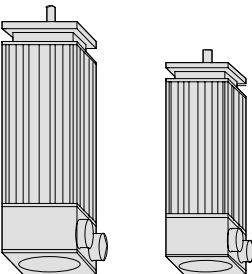
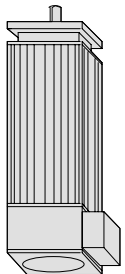
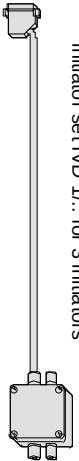
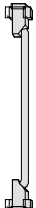
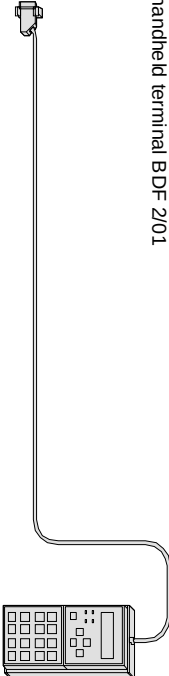
- ◆ COMPAX

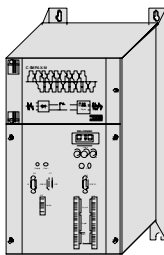
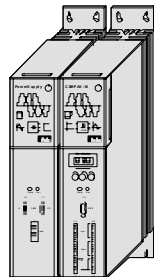
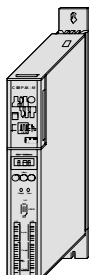
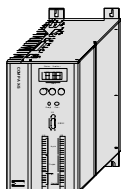
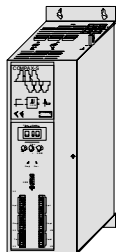
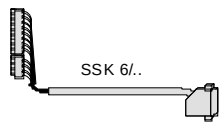
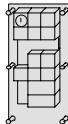
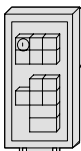
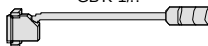
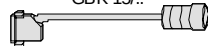
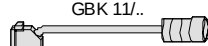
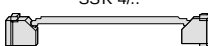
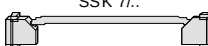
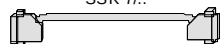
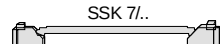
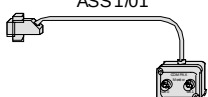
This contains:

- digital inputs and outputs (SPS interface)
- serial interface (RS232)
- front plate with status and error display
- natural language memory
- integrated IGBT final stage
- ◆ mains power module to create the power voltage (without transformer); with emergency stop function.
- ◆ a single-phase option is available for COMPAX P1XXM and you can use this to drive the unit directly off a 230V AC source without a mains power module.
- ◆ drive unit (motor, transmission and cable).
- ◆ aids for controlling COMPAX using the digital inputs and outputs.
- ◆ interface cable for operating COMPAX via the serial interface RS232.
- ◆ options which support other areas of usage.
- ◆ a hand-held terminal for menu-guided configuration and programming of COMPAX.
- ◆ PC software for supported parameter specification and for creating programs.

8.2 Overview

The following table shows the COMPAx system components and the relevant associated cables.

 COMPAx 35XXM		 COMPAx-M with power module NMD		 COMPAx P1XXM		 COMPAx 25XXS		 COMPAx 45XXS COMPAx 85XXS						
Drives														
Synchronous motor					Interfaces									
 MOK 42 / MOK43  REK 32										 HDY 055.. HDY 070.. HDY 092.. HDY 115.. HJ96.. HJ116..				
 MOK 21 / MOK11 / MOK46  REK 32										 HDY 142.. HJ155 HJ190..				
Other motor types										Initiators: IN HE 521506				
Initiator set IVD 1/.. for 3 initiators 					The RS232 - interface is available in the standard device  SSK 1/.. handheld terminal BDF 2/01  					RS 485 ASCII / binary Option F1: 4-Wire Option F5: 2-Wire Interbus-S Option F2 Profibus Option F3 CAN Bus Option F4 CAN open Option F8 CS31-System bus Option F7  SSK13/.. to further bus subscribers				
bus systems  as plug-in option					HEDA as plug-in option  as plug-in option									
HEDA					HEDA Option A3  SSK14/.. BUS 2/01: bus termination at last COMPAx  BUS 2/01: bus termination at last COMPAx					to an IPC with Hauser plug-in board "IPM" for contouring				

COMPAX 35XXM  COMPAX-M with Power module NMD  COMPAX P1XXM  COMPAX 25XXS  COMPAX 45XXS COMPAX 85XXS 	Interfaces			Operating panel BDF 1/02 		Operating panel BDF 1/02 		
		Absolute encoder interface A1 		GBK 1/.. 		Absolute encoder  STEGMANN AA100		
	Options	SinCos option S1/S2 		GBK 15/.. 		SinCos installed in the motor (S1 is not combinable with A1 and E3)		
		Encoder channel 1	Encoder input E2  (with cable connection)	GBK 11/.. 		Encoder  Litton G71SSLDBI-4096-151-050BX		
				SSK 7/.. 		Direct to encoder simulation of COMPAX or SV Drive		
			Encoder channel 2	Encoder input E4  (without cable-connection)	SSK 4/.. 		encoder-distributor EAM 4/01 	to the encoder distributors
		 channel 1 incoming						
		channel 2		encoder simulation option E3 i.e. by SinCos S1 option E8 	SSK 7/.. 		 channel 1 relaying	
			Bus termination BUS 1/01 					
			 channel 2 output					
		D/A - monitor D1 (12 Bit)  Analogue output of intermediate values		ASS 1/01 		Direct to an encoder input e.g. zu COMPAX-M		
		ballast resistors	NMD20	ballast resistor BRM 4/.. with 1,5 m cable obtainable in 3 ratings for connection to the Power module NMD20				
			COMPAX 35XXM	ballast resistor BRM 7/01 with 1.5m cable for connection to COMPAX 35XXM				
			COMPAX 45XXS/ 85XXS	ballast resistor BRM 6/01 with 1.5m cable for connection to COMPAX 45XXS / COMPAX 85XXS				
			COMPAX 2500S	ballast resistor BRM 5/01 with 1.5m cable for connection to COMPAX 25XXS				
		PC-Tools	COMPAX ServoManager with: ParameterEditor and ProgrammEditor CamEditor for COMPAX XX70					

1.3 HAUSER – Motors with unit assignment

The following are features common to all motors:

- ◆ sinusoidal EMC
 - ◆ standard flanges
 - ◆ IP 65 type of protection (shaft IP 64)
 - ◆ insulation class F
 - ◆ integrated resolver
 - ◆ treble nominal torque is possible at treble nominal current for up to 3s.
- Determined by: British Standard BS4999 and/or intern. standard IEC34 • excess temperature: 110K • tolerance: +/-10%

You will find a table of motors with unit assignment on the next page.

8.4 HAUSER linear axes

The HAUSER "HLEc" linear unit is available with various cross sections:

- ◆ **HLE80C** cross section: 80 mm x 80 mm up to length of 6m
- ◆ **HLE100C** cross section: 100 mm x 100 mm up to length of 7m
- ◆ **HLE150C** cross section: 150 mm x 150 mm up to length of 10m

Highly dynamic, modular linear axis "HPLA" with toothed belt drive or rack-and-pinion drive:

- ◆ **HPLA180:** cross section: 180 mm x 180 mm
up to 50m for rack-and-pinion, up to 20m for toothed belt

Electric cylinder ET: of 50 - 1500 mm stroke.

The attached transmissions are available with ratios of 3:1, 5:1, 7:1, 10:1 and 25:1.

 Please contact us if you require more information.

Initiator set

If you are using e.g. a rack-and-pinion drive, toothed belt drive or spindle drive, you can acquire the necessary initiators and initiator connectors and cable from us. We can also supply you with retaining material on request.

Motor
selection
table:

Unit	Nominal current [A _{eff}] for 460V AC	Nom. current [A _{eff}] for up to 400V AC	Peak cur- rent [A _{eff}]	Power [kVA] unit allocation												
COMPAX 35XXM	42.0	50	100	35												
COMPAX 15XXM	21.0	25.0	50.0	17.0												
COMPAX 85XXS	10.5	12.5	25.0	8.5												
COMPAX 05XXM	9.6	11.5	17.0	8.0												
COMPAX 45XXS	5.4	6.5	13.0	4.5												
COMPAX 02XXM	5.4	6.5	8.5	4.5												
COMPAX P1XXM	4.5	5.5	8.5	3.8												
COMPAX 25XXS	-	6.3 ³³	12.6	2.5												
Motor type	Mains power [V]	n _{Nom} [rpm]	M _{Nom} [Nm]	I _{Nom} [A _{eff}]	P _{Nom} [kW]	J [kgmm ²]										
HDY55C4-32S/230V	230	5000	0.35	1.04	0.18	24										
HDY70C4-44S/230V	230	4400	1.15	2.30	0.53	60										
HDY70E4-44S/230V	230	4400	1.75	3.4	0.81	80										
HDY92C4-44S/230V	230	4400	1.20	2.40	0.55	85										
HDY92E4-44S/230V	230	4400	1.85	3.70	0.85	118										
HJ96C6-44S/230V	230	4500	2.6	5.1	1.2	330										
HDY115A6-64S/230V	230	2800	3.40	4.30	1.00	240										
HJ116C6-64S/230V	230	3000	4.6	6.0	1.4	750										
HDY115C6-88S/230V	230	2000	6.0	5.8	1.25	460										
HJ116E6-88S/230V	230	2200	6.5	6.2	1.5	990										
HDY55C4-32S	400	5000	0.35	1.04	0.18	24										
HDY70C4-44S	400	5000	1.10	2.30	0.58	60										
HDY70E4-44S	400	5000	1.7	2.3	0.89	80										
HDY92C4-44S	400	5000	1.16	2.35	0.61	85										
HDY92E4-44S	400	5000	1.8	3.6	0.94	118										
HJ96C6-44S	400	5000	2.5	4.9	1.3	330										
HDY115A6-88S	400	3800	3.2	3.0	1.27	240										
HJ116C6-64S	400	5000	4.0	5.0	2.1	750										
HDY115C6-88S	400	3800	5.2	5.1	2.07	460										
HJ116E6-88S	400	4000	5.4	5.3	2.3	990										
HDY115E6-88S	400	3800	7.5	7.3	2.98	680										
HDY115G6-88S	400	3800	10.0	9.4	4.00	900										
HJ155A8-88S	400	4000	8.3	8.3	3.5	2200										
HDY142C6-88S	400	3800	8.6	8.50	3.42	1150										
HDY142G6-88S	400	3800	16.0	15.60	6.36	2200										
HJ155D8-130S	400	2800	21.5	13.7	6.3	5400										
HJ155F8-130S	400	2800	26.0	17.3	7.6	7500										
HJ190J8-150S ³⁴	400	2400	46.0	27.0	11.6	21000										
HJ190J8-150S/F*(with fan)	400	2400	80.0	46.0	20.1	21000										
HDY115A6-88S	460	4400	3.2	3.0	1.47	240										
HJ116C6-64S	460	5000	4.0	5.0	2.1	750										
HDY115C6-88S	460	4400	4.9	4.9	2.26	460										
HJ116E6-88S	460	4600	5.0	4.7	2.4	990										
HDY115E6-88S	460	4400	7.0	6.9	3.23	680										
HDY115G6-88S	460	4400	9.3	9.3	4.29	900										
HDY142C6-88S	460	4400	8.3	8.3	3.82	1150										
HDY142G6-88S	460	4400	15.5	15.0	7.14	2200										
HJ155A8-88S	460	4600	7.2	7.1	3.5	2200										
HJ155D8-130S	460	3200	20.2	13.1	6.8	5400										
HJ155F8-130S	460	3200	24.0	16.1	8.0	7500										
HJ190J8-150S*	460	2700	42.0	24.0	12.3	21000										
HJ190J8-150S/F*(with fan)	460	2700	79.0	44.0	22.3	21000										

The specified unit allocation reflects the typical applications for which they are used; depending on the application, other unit – motor – allocations may also be useful.



Please contact us if you require more information about our motors.

³³ The nominal current for 230V AC applies to the COMPAX 2500S

³⁴ The HJ190J8 – nominal data is only temporary; note the motor description.

8.5 Data interfaces

8.5.1 RS232

You use the RS232 interface, fitted as standard in COMPAX, to connect COMPAX with a PC or terminal. You can then use this other device to operate COMPAX. The SSK1/.. interface cable is available as a connecting cable (for lengths available, refer to page 159).

8.5.2 Bus systems

The bus systems are options which you can select to use or not. They require an additional board to be fitted in COMPAX. The connection is located on the mains power module or, in COMPAX-S and COMPAX 35XXM, directly on the unit. The controllers, connected to the mains power module or COMPAX 35XXM, are already connected via the flatband cable available in the system network.

8.5.2.1 Interbus S / Option F2

You will find an object directory in the special documentation. The connection assignment is arranged in the specifications for the 2-conductor remote buses.

8.5.2.2 RS485 / option F1/F5

The RS485 interface is described in the special documentation. 2 different options are available:

- ◆ F1: 4 wire RS485 F5: 2 wire RS485

8.5.2.3 Profibus / option F3

The Profibus is described in the special documentation. Functions:

- ◆ Sinec L2-DP and FMS
- ◆ 1.5M Baud

8.5.2.4 CAN bus / option F4

The Profibus is described in the special documentation. Functions:

- ◆ BasicCAN
- ◆ up to 1M Baud
- ◆ CAN protocol in accordance with specification 1.2
- ◆ hardware in acc. with ISO/DIS 11898.

8.5.2.5 CANopen / option F8

- ◆ Protocol in accordance with CiA DS 301
- ◆ Profile CiA DS 402 for drives.

8.5.2.6 CS31 system bus / option F7

- ◆ COMPAX – ABB – interface.

8.6 Process interfaces

8.6.1 Encoder interface

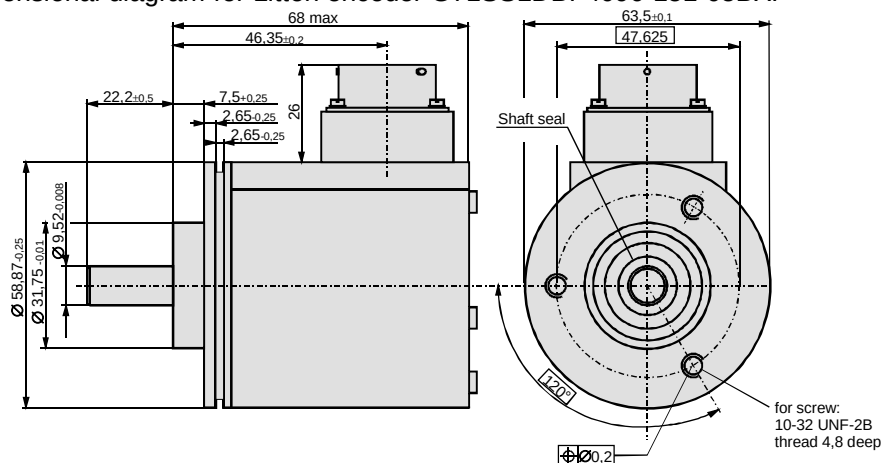
The encoder interface option E2 (E4) enables the connection of an external incremental encoder (of the type Litton encoder G71SSLDBI-4096-151-05BX). You can use this to synchronize COMPAX to an external speed using the "SPEED SYNC" command. The encoder pulses per revolution and the translated travel per encoder revolution are set via the COMPAX parameters P143 and P98.

No.	Meaning	Unit	Minimum value	Default value	Maximum value	valid as of...
P98	Travel of axis per encoder revolution	corresp. P90	0	0	4 000 000	VC
P143	Encoder pulses per revolution (channel 1)		120	4096	2 000 000	VC
P146	Resolution of encoder emulation (channel 2) (for the permanent SinCos setting, refer to page 145)	=0: 1024 =8: 512				VC

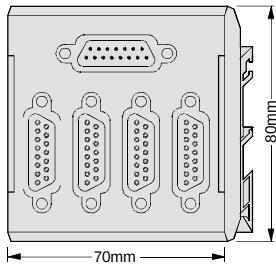
Technical data:

- ◆ RS422 interface
- ◆ 5V supply;
- ◆ 120-10 000 increments/revolution ($f_{\min}$: 4 kHz; $f_{\max}$: 500 kHz).

Dimensional diagram: Dimensional diagram for Litton encoder G71SSLDBI-4096-151-05BX:



Encoder module and accessories:

E2	Encoder input module with terminator for individual connections; not for creating an encoder bus.
E3 / E8	E3: encoder emulation for motor with resolver. E8: encoder emulation for motor with SinCos (refer to page 145)
E4	Encoder input module without terminator for creating an encoder bus.
EAM4/01 Design:	Encoder distributor for creating an encoder bus.  Depth: 40 mm without mating connector The module is engaged on the terminal bus bar.
BUS1/01	Bus terminator.
GBK11/..	Encoder cable for connecting COMPAX with an encoder.
SSK7/..	Connector cable between encoder distributors or from encoder emulation.
SSK4/..	Connector cable between COMPAX and encoder distributor.

Assignment of EAM4/01 (corresp. X13)

	Channel 1		Channel 2	
Pin	X1: IN	X2: OUT	X3: IN	X4: OUT
1	Screen	Screen	Screen	Screen
2	NC	N1	NC	N2
3	NC	B1	NC	B2
4	NC	A1	NC	A2
5	N1	NC	N2	NC
6	B1	NC	B2	NC
7	A1	NC	A2	NC
8	+5V	NC	+5V	NC
9	NC	N1/	NC	N2/
10	NC	B1/	NC	B2/
11	NC	A1/	NC	A2/
12	N1/	NC	N2/	NC
13	B1/	NC	B2/	NC
14	A1/	NC	A2/	NC
15	GND	NC	GND	NC

Applications with encoder:

Individual connections

Encoder COMPAX

- ◆ Cable: GBK 11/..
- ◆ Encoder input module E2 with terminator

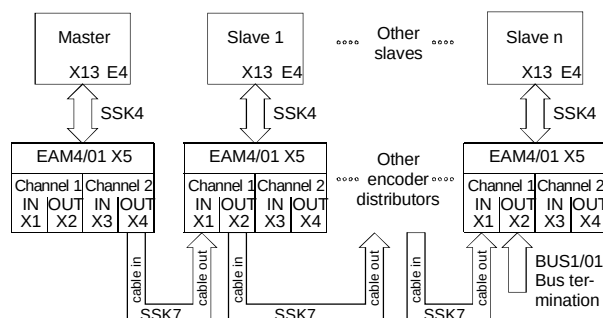
SV drive COMPAX

- ◆ Cable: SSK 7/..
- Attention! Note direction.
cable in: SV drive cable out: COMPAX
- ◆ Encoder input module E2 with terminator

COMPAX COMPAX

- ◆ Cable: SSK 7/..
- Attention! Note direction
cable in: COMPAX with encoder emulation
cable out: COMPAX with encoder input
- ◆ Encoder emulation E3 for COMPAX (master)
- ◆ Encoder input module E2 for COMPAX (slave)

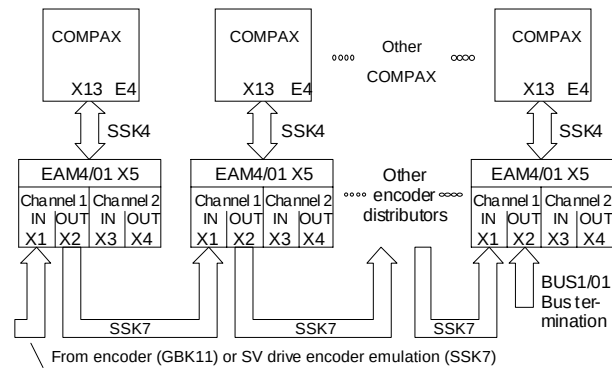
Encoder bus with COMPAX



The following are required:

- ◆ per COMPAX
 - one encoder distributor **EAM 4/01**
 - one cable for the COMPAX and encoder distributor connection **SSK 4/..**
 - one bus cable for connecting the encoder distributors **SSK 7/..**
- ◆ encoder emulation in the master **E3**
- ◆ encoder input module in each slave **E4**
- ◆ bus terminator **BUS 1/01**

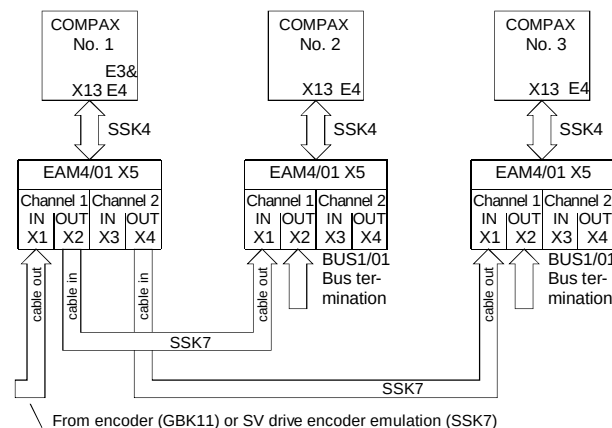
Encoder bus with encoder or encoder emulation in SV drive



The following are required:

- ◆ per COMPAX
 - one encoder distributor **EAM4/01**
 - one cable for the COMPAX and encoder distributor connection **SSK4/..**
 - one bus cable for the connection between the encoder distributors **SSK7/..**
- ◆ encoder input module **E4**
- ◆ bus terminator **BUS1/01**
- ◆ **For the encoder:** encoder cable **GBK11/..**
- ◆ **For the SV drive:** cable: **SSK7/..**

Encoder bus mixed



- ◆ COMPAX 1 and COMPAX 2 receive the signals from one encoder.
- ◆ COMPAX 3 receives the actual COMPAX 1 value concerning its emulation.

The following are required:

- ◆ per COMPAX
 - one encoder distributor **EAM4/01**
 - one cable for the COMPAX encoder distributor connection **SSK4/..**
- ◆ 3 bus cables **SSK 7/..**
- ◆ 2 bus terminators **BUS1/01**

Encoder module:

- ◆ COMPAX 1:
 - encoder input module **E4**
 - encoder emulation **E3**
- ◆ COMPAX 2, 3:
 - encoder input module **E4**
 - encoder cable: **GBK11/..**

8.6.2 Absolute value sensor (A1)

When using option A1 (the absolute value sensor interface), reference travel (Find machine zero) is not required as it usually always is in normal mode once the mains power supply has been switched on. The reference travel is then only required during start-up.

The following are supported:

- ◆ Stegmann - absolute value sensors of the types
- ◆ AG100MS/GRAY 4096/4096
- or
- ◆ AG626XSR 4096/4096.

Technical data

- ◆ Voltage supply: 24V $\pm 10\%$.
- ◆ Sensing code: Gray code, single-step
- ◆ Direction of counting: clockwise, when looking at the shaft: rising.
- ◆ Data interface: RS422 /24 bit data format (starting with: MSB).
- ◆ Cycle frequency: 100 kHz.

Approval of absolute value sensor input

When using equipped A1 option (if this is not already being performed by HAUSER), the absolute value sensor input is approved using parameter P206.

Meaning:

P206 = "1" absolute value sensor input approved.

Note! ◆ Only activate the absolute value sensor input, if an absolute value sensor has been connected correctly and physically.

◆ Continuous mode is not permitted when the absolute value sensor is active.

Note: Option A1 also contains the HEDA interface (as is described below).

8.6.3 High-resolution SinCos sensor system (S1/S2)

COMPAX uses option S1 to support the high-resolution, optical motor position recording process via the Stegmann SinCos sensor system (as a substitute for the motor position recording via resolver).

SinCos Singleturn: Type SCS60 or SRS60

SinCos Multiturn: Type SCM60 or SRM60

A SinCos sensor provides the following improvements.

- Better concentricity.
- Position recorded with greater absolute accuracy:
Resolver: $\pm 0.25^\circ$
SinCos: $\pm 0.005^\circ$
- Resolution of motor speed:
Resolver: 16/12 bit (speed-dependent ; 12 bit at higher speeds)
SinCos: 19 bit over the whole range of motor speeds.
- Less noise at a higher dynamic level via the motor speed resolution.
- With the SinCos Multiturn you also get an economical absolute value sensor function.
4096 motor revolutions detected absolutely.

Attention!

The S1/S2 options cannot be combined with:

- the option A1 (absolute value sensor/HEDA) and
- option E3 (encoder emulation).

Cannot be combined:

S1 - A1
S1 - E3

SinCos with HEDA and/or encoder emulation

We are now supplying 2 new options for SinCos applications using HEDA and / or encoder emulation:

HEDA option A3

HEDA option without the support of an external absolute value sensor (AG...). Option A3 can be used independently of option S1.

Encoder emulation option E8: encoder emulation with SinCos support

Option E8 is an encoder emulation (on connector X13: channel 2) with a resolution of

- ◆ 512 bit / motor revolution for SCS60 and SCM60
 - ◆ 1024 bit / motor revolution for SRS60 and SRM60;
- however, neither have encoder zero pulses.

S2 – option:**SinCos Multiturn with programmable transmission factor**

When using a SinCos Multiturn, you can use the S2 option to adapt the range of the absolute position S12 to your application via a transmission factor. S12 then always contains the position value referenced to the reset route P96.

Standard:

SinCos Multiturn records an absolute position of 4096 revolutions.

In applications such as controlling a round table via a transmission, the position of the table cannot be determined very accurately because 4096 rotations usually signifies several rotations of the table.

By specifying the transmission factor P96 (ratio of motor : table), the absolute position S12 is reset to 0 after a table rotation. After "Power on" and after an error has occurred, S12 is transferred as the actual value (S1=S12).

The function is switched on via P206="1".

No.	Meaning	Unit	Minimum value	Default value	Maximum value	valid as of...
P96	Transmission factor for the reset route of the S2 – option ("0": no reset function)	-	0	0	4095	VC
P206	Approval of the absolute value sensor input or the reset functions of the S2 option	="1": absolute value sensor input approved or reset function switched on.				VP

Please note

- ◆ Option S2 cannot be combined with A1 or E3 (also refer to page 145)
- ◆ Set P1=0. Using P212=10 (refer to page 57), you can, nevertheless, select the machine zero point any way you wish.

Note!

This function does not affect the actual positioning process.

Example: P96=10 (revolutions); P83=400 000 mm (400 mm)

After POSA 450 and an ensuing POSA 0, the drive reverses by 450 mm (and not only by 50 mm).

If you want to perform a positioning process within the reset route and you have been traveling in one direction for a long time, you can do this by evaluating S12.

E.g.: desired position within the reset route = 10 mm

V1=10-S12

POSR .V1

8.6.4 HEDA interface

⇒ HEDA at option A3 for COMPAX XX00, COMPAX XX60 and COMPAX XX70.

To implement track and contour tasks with the HAUSER interpolation module (IPM) for PC and IPC.

Communication occurs via the **HEDA** interface; a rapid synchronous serial interface between IPM and the COMPAX network.

Functional scope of the IPM and COMPAX network:

u contours can be stored for up to 9 axes with up to 100 000 points.

u 16 datum-related digital outputs.

u data exchange between 9 axes within 1 ms (nominal values, auxiliary functions, positions, lag errors, speeds, torque).

u all inputs and outputs can be freely programmed.

(Once approved via P221 and P225, the outputs can also be assigned to HEDA via P245 and P245; refer to page 108).

u internal natural language memory can still be fully used.

u capable of operating independently as a single axis positioning system.

◆ physical transfers:

- RS485 level (counter-cycle driver);
- separated using an optical coupler;
- cycle frequency: 5 Mbit/s.

⇒ Descriptions of how to work with the HEDA interface can be found on page 132 onwards.

8.6.5 D/A monitor (D1)

- ◆ The D/A monitor offers you the chance of outputting COMPAX internal measurement parameters and intermediate parameters in the form of analogue voltage in the range of $\pm 10V$. For description, refer to page 39.

8.6.6 Analogue speed specification (E7)

Only in COMPAX
XX6X and
COMPAX XX70

⇒ Option E7 "Analogue speed specification" is only available in COMPAX XX6X "Electronic transmission" and COMPAX XX70 "Electronical curve control".

The "Encoder input" option (E2 or E4) cannot be used at the same time as E7.

Using option E7, you can specify a nominal speed value via connector X13 as analogue voltage in the range -10V to +10V. You can use 2 digital inputs (SPS level), to define a nominal speed value of 0 and to initiate a change in the rotational direction.

Configuration: The following configuration data must therefore be assigned permanent values:

P80 = "16" (general drive).

P90 = "1" (mm unit).

P83 = 100 000 mm (travel per motor revolution).

P93 = "4" (speed control mode).

P143 = 600 000

P144 = "7" (analogue speed specification).

P35 = "1" (transmission factor 1) (I15="0")

I16 = "1" (external nominal value is valid)

These parameters influence the interrelation between voltage and speed; they must therefore be specified and fixed. Specify the desired speed directly via P98 in rpm when input voltage is +10V .

Accuracy

Linearity error: <1%

Amplification error: <5% (you can compensate for these with P98).

Offset: <15 mV

Temperature drift: 100 ppm/K

**Connection
arrangement**

Connector X13: channel 0

Pin X13 and EAM4/01: X1 (previous arrangement)	COMPAX input I output O	Signal	Circuit proposal
6 (B1)	O	+15V <10 mA	
7 (A1)	I	UE	
13 (B1\)	O	-15V <10 mA	
15 (GND)	O	GND	
14 (A1\)	I	UE\	Bridge to 15 (GND)
5 (N1)	I	Release	"1" for release "0" ≡ nominal digital value 0
12 (N1\)	I	Direction of rotation	"1" for positive direction of rotation
1		Screen	

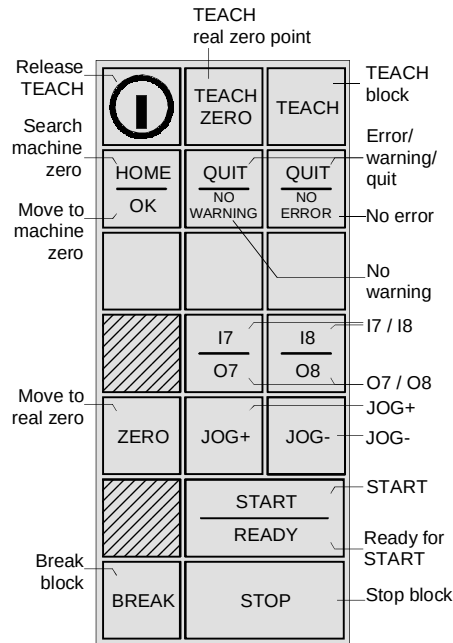
Level on the "release" and "direction of rotation" inputs: 5.5V...30V = "1".

⇒ U_E and U_{E\} are differential inputs. Actively assign U_{E\} to a potential (e.g. to GND).

8.7 Accessories

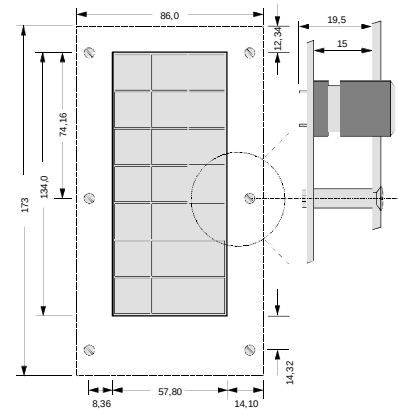
8.7.1 External control field

You can use the control fields to control COMPAX via the digital inputs. They contain the following functions:

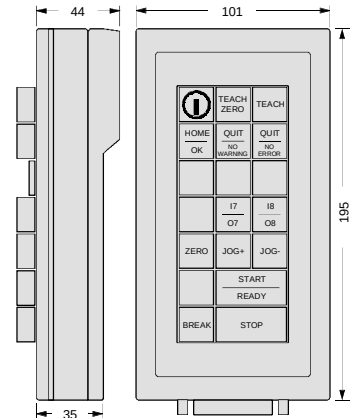


The control field is available for front plate installation or with housing.

BDF1/02: for front plate installation

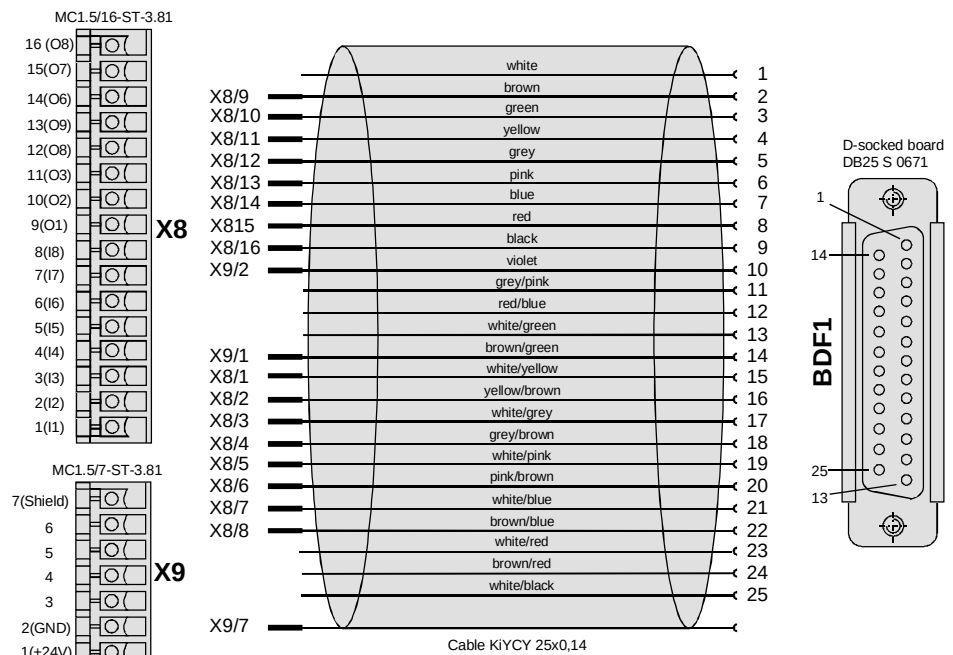


BDF1/03: with housing



➡ The control fields are connected with COMPAX via the cable SSK6/..

Wiring plan and arrangement of SSK6/..



8.7.2 MC measures

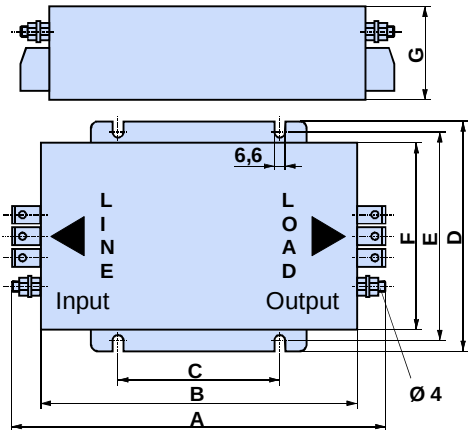
8.7.2.1 Grid filter

You can acquire the following grid filters for radio suppression and/or for complying with emission limit values in accordance with EN61800-3.

Order no.: 073-605206

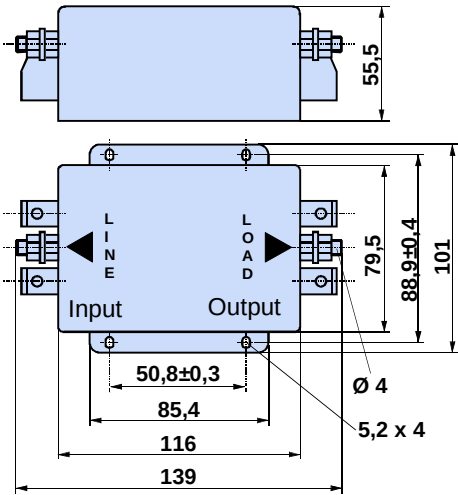
NMD10 / COMPAX
45XXS / 85XXS:

NMD20: Order no.: 073-605207
Dimensional diagram:



	073-605206	073-605207
A	177	240
B	151	217
C	70±0.3	115±0.3
D	140	159
E	125	145±0.5
F	111	129
G	65	64

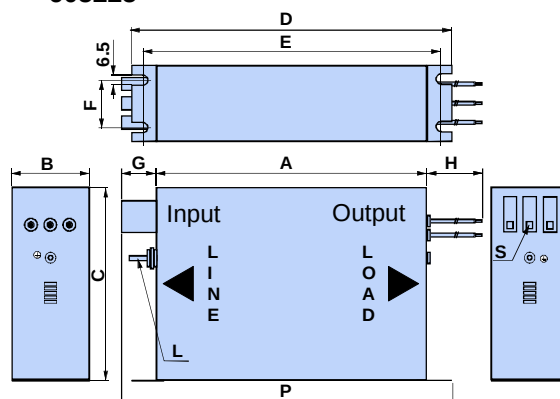
COMPAX 25XXS: Order no.: 073-605201
Dimensional diagram:



COMPAX 35XXM:

Type: 073-605220

◆ COMPAX 35XXM with sequential COMPAX-M controllers: Type: 073-605225



	073-605220	073-605225
A [mm]	307	302
B [mm]	61	81
C [mm]	152	187
D [mm]	337	331
E [mm]	320	314
F [mm]	35	55
G [mm]	25	39
H [mm]	400	500
L	M5	M6
P [mm]	347	356
S [mm ²]	10	25

Length of connection between grid filter and unit

◆ unsheathed: <0.5m

◆ sheathed: <5m

8.7.2.2 Motor output throttle

We supply motor output throttles for suppression when using long motor lines (>20m):

Up to 16A nominal motor current:

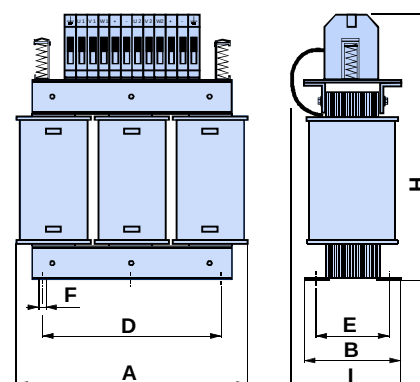
◆ Type: 048-300010 16A / 2 mH

Up to 30A nominal motor current:

◆ Type: 048-300020 30A / 1.1 mH

Above 30A – nominal motor current:

◆ Type: 048-300030 >30A / 0.64 mH.

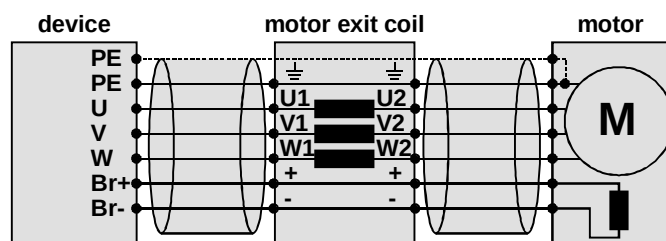


Position of motor output throttle

Close to unit; max. 3m cable.

	048-300010	048-300020	048-300030
A [mm]	150	180	205
B [mm]	67	76	107
D [mm]	113	136	157
E [mm]	50	57	83
F [mm]	6	6	7
H [mm]	195	195	260
I [mm]	95	110	150

wiring of motor output throttle

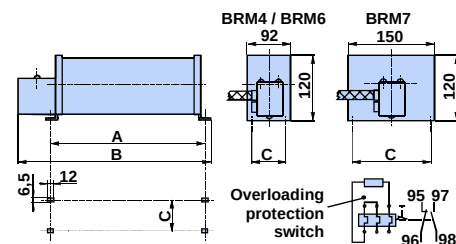


8.7.3 External ballast resistances for COMPAX and NMD20

External ballast resistances:

Brake performance	Lasts for	Cooling down time
NMD20 with external ballast resistance of 15W		
BRM4/01: 0.57 kW	unlimited	
Dynamic 37 kW	<0.4s	>120s
BRM4/02: 0.74 kW	unlimited	
Dynamic 37 kW	<0.6s	>120s
BRM4/03: 1.50 kW	unlimited	
Dynamic 37 kW	<1.2s	>120s
COMPAX 25XXS with external ballast resistance of 56Ω		
BRM5/01: 250W	unlimited	
Dynamic 2.5 kW	<2s	³ 25s
COMPAX 4500S/8500S with external ballast resistance of 22Ω		
BRM6/01: 450W	unlimited	
Dynamic 37 kW	<0.4s	≥120s
COMPAX 35XXM with external ballast resistance of 10W		
BRM7/01: 2.00 kW	unlimited	
Dynamic 37 kW	<0.4s	>120s

Dimensional diagram: BRM4, BRM6 and BRM7

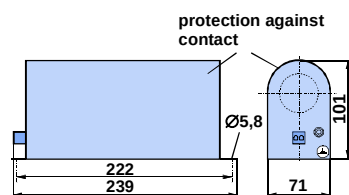


	BRM4/01	BRM4/02	BRM4/03	BRM6	BRM7
A	250	300	540	250	560
B	330	380	620	330	640
C	64	64	64	64	150



The ballast resistances are fitted with a 1.5m connection line. Note that a length of >2m is not permissible.

Dimensional diagram: BRM5/01



BRM5/01 is fitted with a 0.3m connection line. Note that a length of >2m is not permissible.



Danger!

Housing temperature may reach 200°C.

The external ballast resistances should be fitted so that it ensures contact protection.

The housing temperature of the ballast resistance may rise to 200°C depending on the application.

Fit the connection lines at the bottom.

Observe the information on the resistances (warning signs).

8.7.4 ServoManager

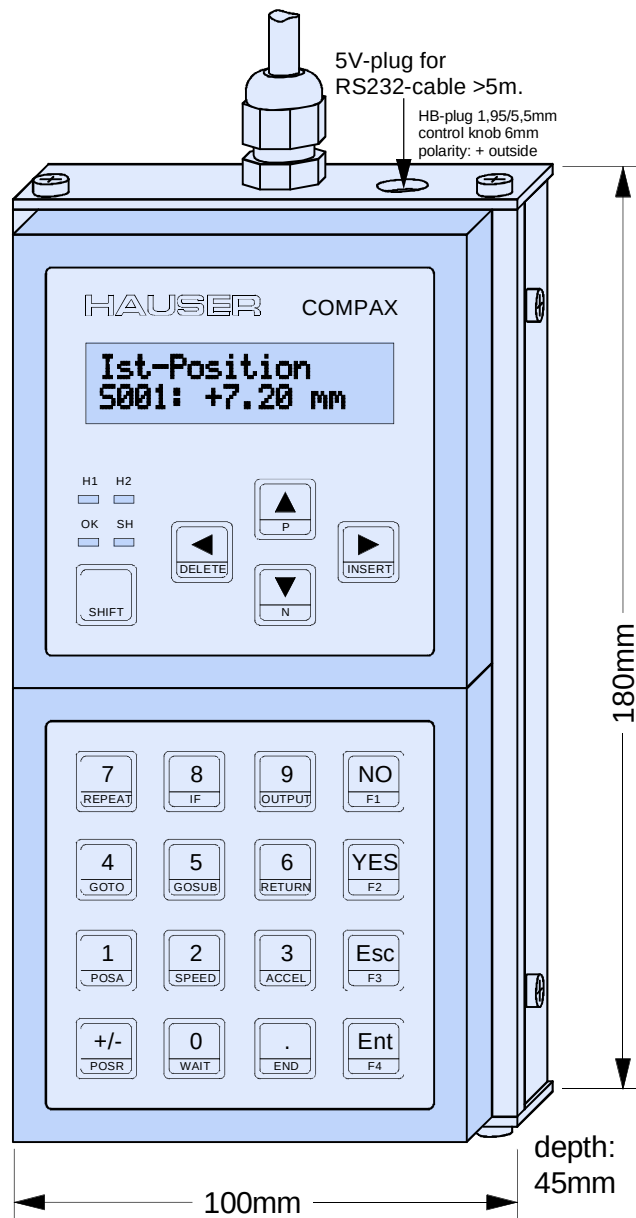
You can use the ServoManager to process complete COMPAX projects; this part falls within the COMPAX scope of delivery. It contains the following program modules:

- ◆ ParameterEditor: for configuring and setting parameters for COMPAX.
 - ◆ ProgramEditor: for creating COMPAX programs
 - ◆ Terminal: for working directly on the connected COMPAX.
- The ServoManager and the program modules are described in a separate manual.

8.7.5 Hand-held terminal

The BDF2/01 hand-held terminal is a comfortable aid with which you can operate COMPAX and easily configure menu-guided tasks. The hand-held unit is connected with COMPAX X6 and supplied with energy via the RS232 interface. It is therefore very suitable for rapid diagnosis and for supporting the start-up.

Design:



Hand-held terminal

- Functions** The hand-held terminal contains the following functions:
- ◆ displays any status value.
 - ◆ menu-guided configuration.
 - ◆ viewing and editing of programs.
 - ◆ viewing and editing of parameters.
 - ◆ direct entry of commands.

Key functions The keys are all assigned two functions. First press the SHIFT key if you wish to activate the second function of a key. The second function is in the lower section of the key and is turquoise-colored.

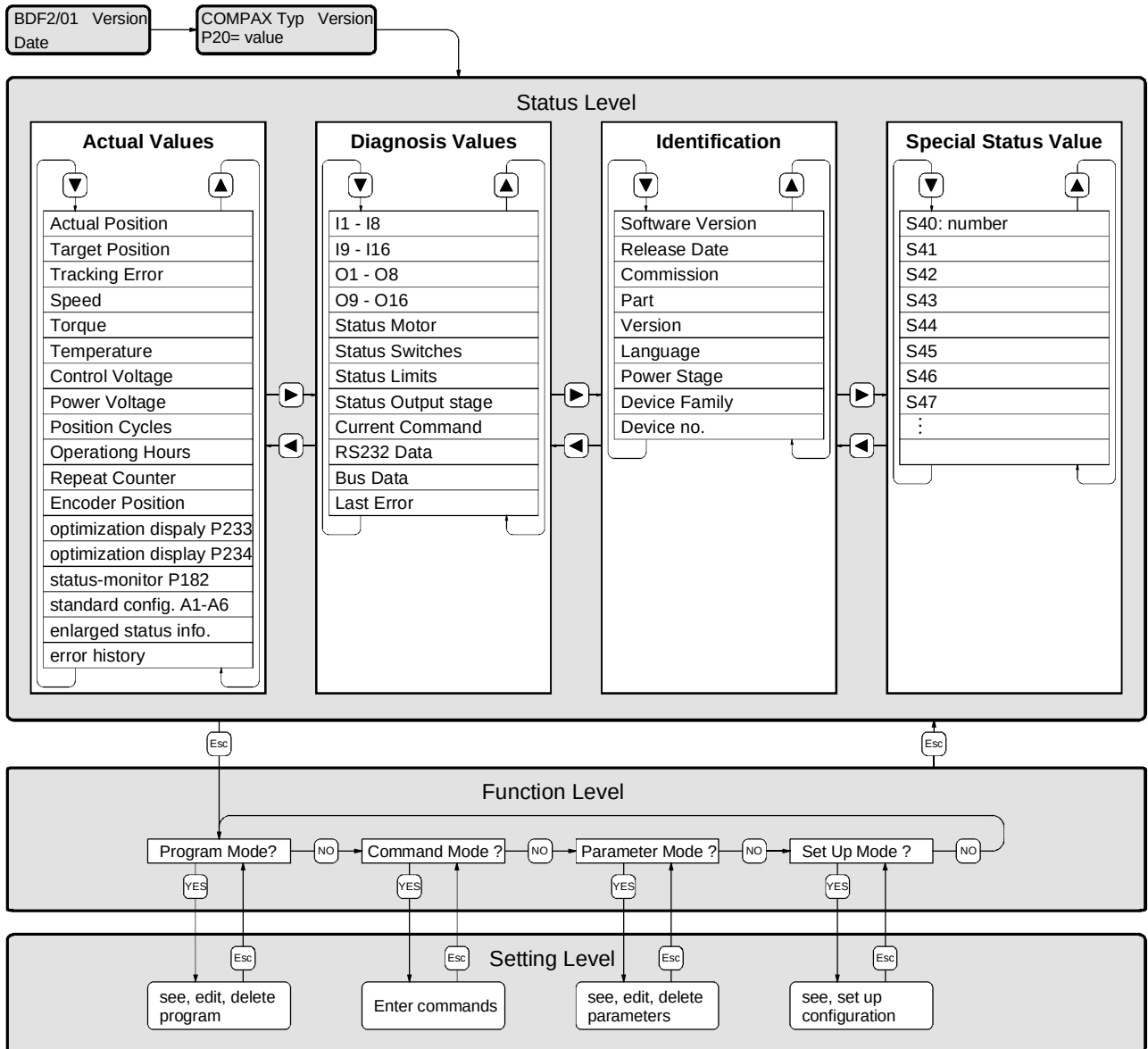
Keys	Function
NO	Answers a question negatively
YES	Answers a question positively
ESC	Escape
ENT	Confirms and transfers
SHIFT	Selects second function of the key: press once: on; press again: off
DELETE	Deletes program data records, all jumps to addresses are automatically corrected
INSERT	Inserts program data records, all jumps to addresses are automatically corrected
P	Directly selects the parameter entry
N	Directly selects the program memory
F3	Quit
Special functions	
WAIT Ent	WAIT START
GOTO Ent	GOTO EXT
GOSUB Ent	GOSUB EXT
SPEED Ent	SPEED SYNC
Special COMPAX XX70 commands	
F1	SETC x
F2	SETM x
F3	SETS
F4	LOOP x
POSR Ent	POSR CAM

Lit-up display	Function	
	dark	bright
H1 (red)	No error	Error
H2 (amber)	No warning	Warning: cooling body temperature >70°C
OK (green)	Unit not ready	Unit ready for operation
SH (amber)	First key function	Second key function (SHIFT key has been pressed)
All	No voltage	Unit not ready for operation

Supply The cable is 1.5 m long. The hand-held terminal is also supplied by this cable. If the distances involved are longer (>5m), the hand-held terminal will require a direct supply if it is to operate without the risk of interruptions.

Error handling When an error message is present, you can modify the parameter and/or the configuration. To do this, press ESC; the error display goes out and the menu appears. The H1 LED indicates that the error is still present. Once you have modified the parameter, you can acknowledge the error using F3.

Menu:

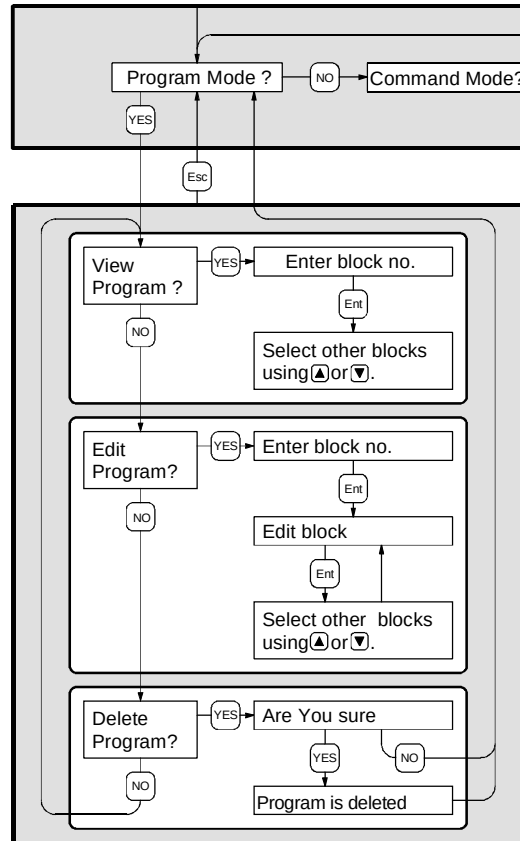


⇒ When the hand-held terminal is connected to COMPAX, the password remains the same.

⇒ The menu items of the setting levels are described below.

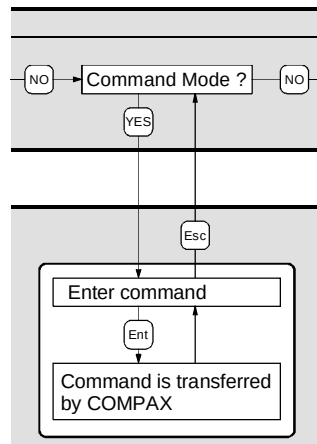
Hand-held terminal

Viewing, editing, deleting program



Commands or numerical values are modified by overwriting them.

Direct command entry



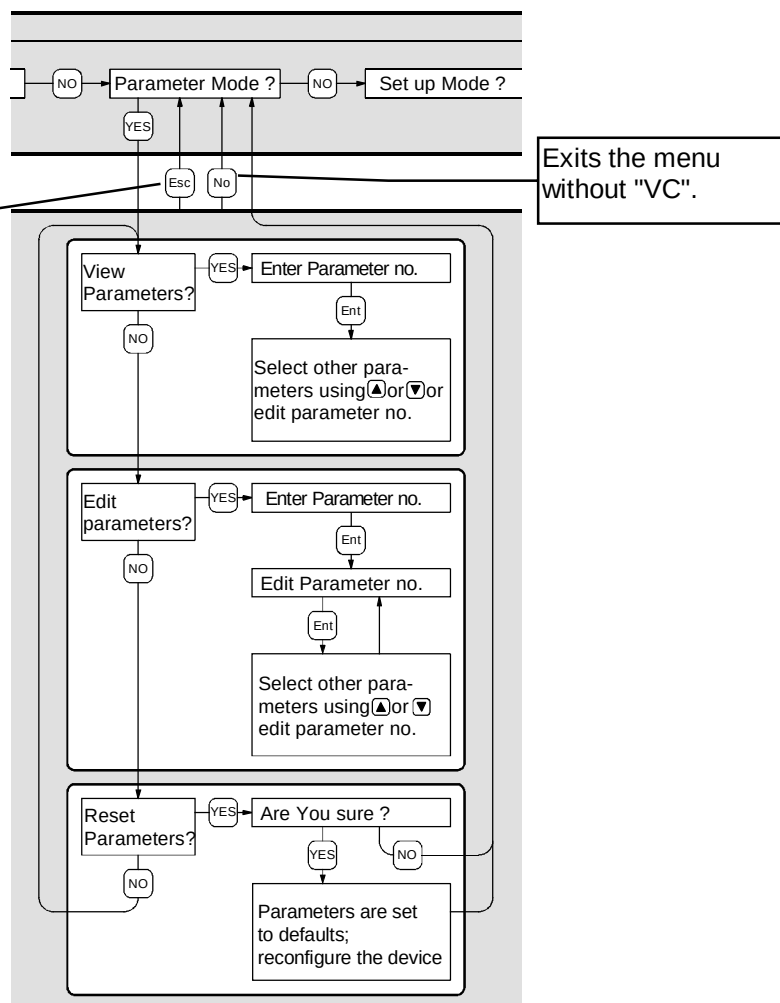
Once you have transmitted the command using "Ent", this command reappears in the display and it can be modified and transmitted again.

Special control function

When OUTPUT A.="X", the cursor is below "X" once the command has been transmitted. The value can be modified and transmitted.

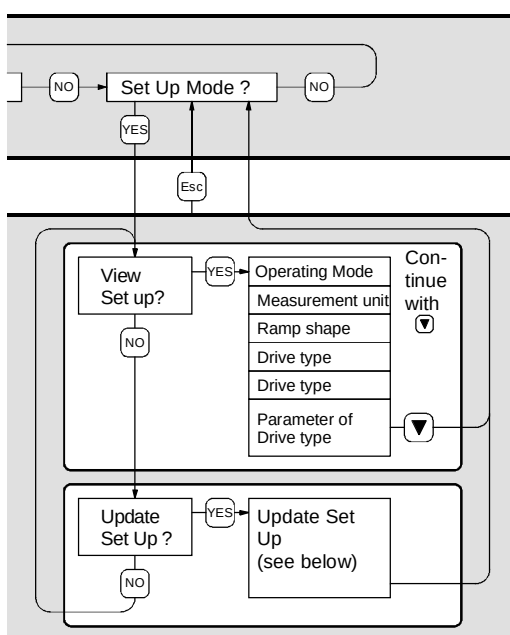
Viewing, editing and resetting parameter

"VC" is created when you exit the menu.

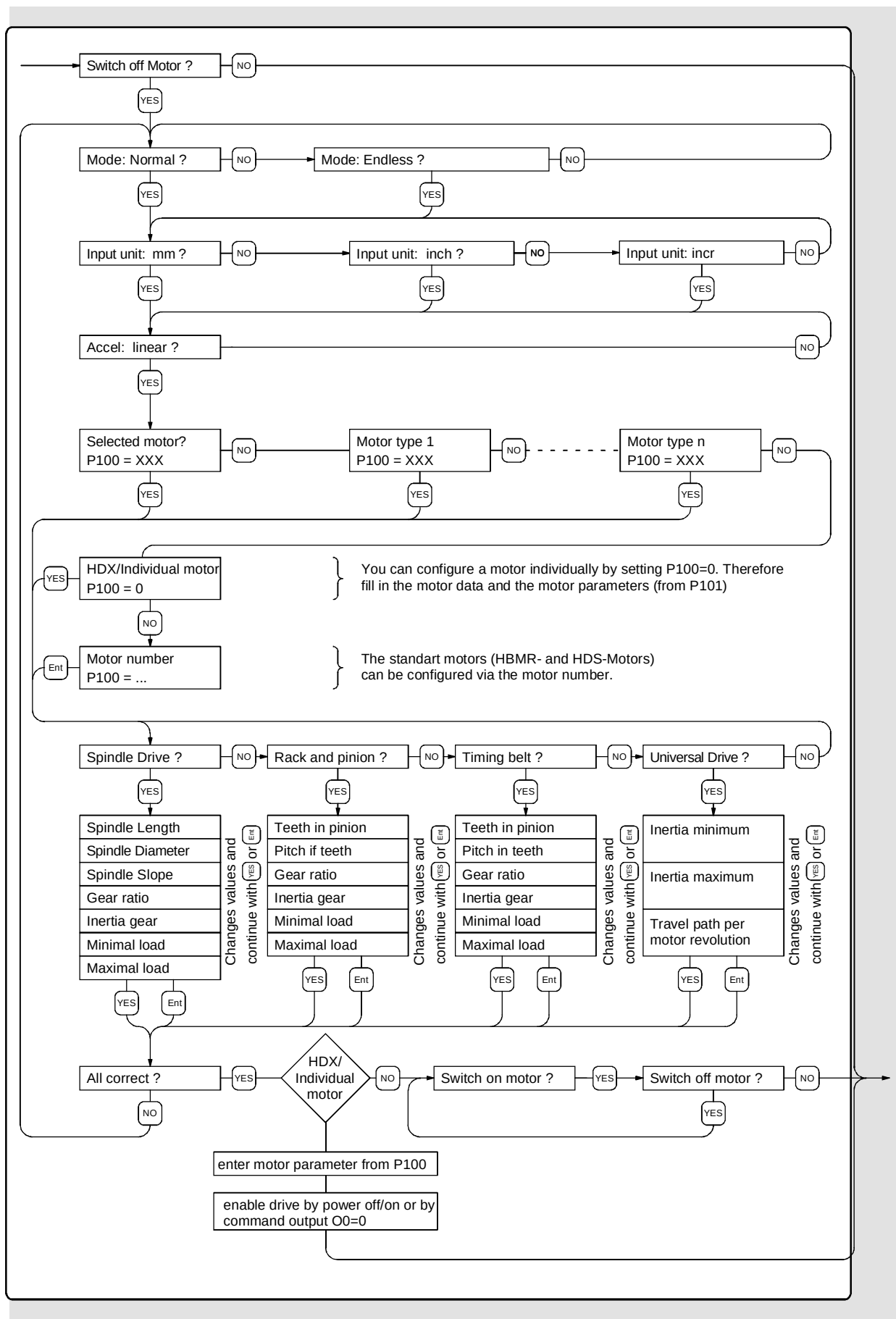


- ◆ When you exit the "Parameter edit" menu using "Esc", the "VC" command (transfer configuration) is transmitted to COMPAX. The configuration parameters are therefore only valid as of this moment in time.
- ◆ When exiting the "Parameter edit" menu using "NO", the "VC" command is not transmitted.

Viewing, setting configuration



Setting configuration



8.8 Annex: the COMPAX components

Mains power module for COMPAX-M (not for COMPAX 35XXM)	
NMD10	Up to 3x500 V AC mains supply connection; direct mains supply operation 10 kW continuous output
NMD20	As NMD10, however 20 kW continuous output; external ballast resistance possible in 3 sizes.
HDY and HJ motors	
You will find information about our range of motors in the motor documentation.	
Motor and resolver cable for HDY and HJ motors	
You will find the motor and resolver cables on page Fehler! Textmarke nicht definiert..	
HAUSER linear unit and initiator equipment	
HLE80	80 mm edge length and up to 6m length
HLE100 (A)	100 mm edge length and up to 7m length
HLE150	150 mm edge length and up to 10m length
Initiator equipment	IVD1.. Initiator distributor connector with cables of the following lengths [m]: 2.5; 5; 7.5; 10; 12.5; 15; 20; 25; 30; 35; 40; 45; 50
	Initiator PNP induction proximity switch: IN HE 521 506 with 6m cable.
Accessories	
BDF2/01	Hand-held terminal for configuring and operating COMPAX
BDF1/03	External control field with housing and without cable
BDF1/02	External control field for front plate installation without cable
SSK6/..	Interface cable between control field and COMPAX available in the following lengths: 2.5; 5; 7.5; 10; 12.5; in [m]
SSU1/01	RS232 - RS485 converters used in conjunction with option F1
GBK16	COMPAX – motor cable for disposing of SinCos.
Encoder: GBK11/..	Encoder cable for connecting COMPAX with an encoder.
EAM4/01	Encoder distributor for creating an encoder bus.
BUS1/01	Bus terminator
SSK4/..	Connection cable for COMPAX encoder distributor.
SSK7/..	Connection cable between encoder distributors or from an encoder emulation.
ASS1/01	Monitor box for drawing out internal measurement signals with D1 option.
SSK1/..	RS232 Interface cable for PC COMPAX, available in the following lengths: 2.5; 5; 7.5; 10; in [m]
Ballast resistances	NMD20: BRM4: 0.57 kW-1.5 kW (15W) COMPAX 25XXS: BRM5/01: 250W (56W)
	COMPAX45XXS/85XXS: BRM6/01: 450W (22W) COMPAX 35XXM: BRM7/01: 2 kW (10W)
Grid filter	NMD10 / COMPAX 45XXS / COMPAX 85XXS: 073-605206 NMD20: 073-605207
	COMPAX 35XXM: 073-605220 or 073-605225 (with additional COMPAX-M) COMPAX 25XXS: 073-605201
Motor output throttle	For motor lines >20m: no.: 048-300010 (16A/2 mH) • 048-300020 (30A/1.1 mH) • 048-300030 (>30A/0.64mH)
Assembly angle plate	MTS2: for indirect wall installation (cooling body in separate heat chamber) of COMPAX 02/05/15XXM
Fan set for NMD	Fan set for NMD10 and NMD20 to increase the max. brake performance
ServoManager	For reading and describing COMPAX parameters and programs
Options	
F1	4-wire RS485 interface F5 2-wire RS485 interface
F2	Interbus S interface F3 Profibus F7 CS31 F8 CANopen F4 CAN bus
E2	Encoder interface with terminator for individual connections.
E3	Encoder emulation for resolver (cannot be combined with S1)
E4	Encoder interface without terminator for creating an encoder bus.
E7	Analogue speed specification only available for COMPAX XX6X and COMPAX XX70.
E8	Encoder emulation for SinCos
A1	Absolute value sensor Cable to COMPAX: GBK1.. lengths: 2.5; 5; 7.5; 10; 12.5; 15; 20; 25; 30; 35; 40; 45; 50 [m]
A3	HEDA interface Cable COMPAX/COMPAX: SSK14/.. lengths: 2.5; 5; 7.5; 10; 12.5; 15; 20; 25; 30; 35; 40; 45; 50 [m]
D1	D/A monitor To perform the measurement signals, you will need monitor box ASS1/01.
S1	Sensor interface for SinCos, Singleturn or Multiturn S2 Programmable sensor interface for SinCos Multiturn

9. Annex

9.1 Status values of standard unit (COMPAX XX00)

Actual values

Designation	Status no.	Unit	Meaning
Actual position	S01	corresp. P90	Current position based on real zero.
Target position	S02	corresp. P90	End position of the current or last positioning cycle implemented.
Lag error	S03	0.1 [corresp. P90]	Difference between nominal and actual position during a positioning cycle.
Velocity	S04	[%]	Present processing velocity of the axis.
Torque	S05	[%]	Present torque as a percentage of the nominal motor torque.
Temperature	S06	[°C] C is transmitted	Temperature of output end stage (≤ 85°C)
Control voltage	S07	[V]	Value of control voltage
Mains power	S08	[V]	Value of power or intermediate circuit voltage
Travel cycle	S09	-	Number of axis motional cycles.
Operating hours	S10	[h]	COMPAX controller operating hours
Repeat counter	S11	-	Loop counter of an active REPEAT loop.
Sensor position	S12	corresp. P90	Position of absolute value sensor (option A1) not available in COMPAX XX10 and COMPAX XX30.
Optimization display	S13		With optimization parameter selected using P233.
Optimization display	S14		With optimization parameter selected using P234.
Status monitor	S15		D/A monitor value selected using P182.
Status bits 1	S16		Information on the status outputs O1...O6 & the last OUTPUT O0 command
Status bits 2	S17		Information about COMPAX status.
Error history	S18		The last 4 errors and type of acknowledgement. Refer to below. (only errors E1 ... E56)

Diagnosis values

Designation	Status no.	Meaning
I1-I8	S19	Logical signal level of inputs 1...8
I9-I16	S20	Logical signal level of inputs 9...16
O1-O8	S21	Logical signal level of outputs 1...8
O9-O16	S22	Logical signal level of outputs 9...16
Drive status	S23	Diagnosis values for the status of the drive. (see below for meaning)
Switch status	S24	Diagnosis values for the status of the switch. (see below for meaning)
Limits status	S25	Diagnosis values for the limit value monitoring . (see below for meaning)
Final stage status	S26	Diagnosis value for the status of the final stage.
Present data record	S27	Display of the data record currently being performed.
RS232 data	S28	reserved
Bus data	S29	Interbus S data / SPS data interface / RS485
Last error	S30	Error number of the last error to occur (only errors E1 ... E56).

Unit designations

Designation	Status no.	Meaning		
Software version	S31	Designation of software version.		
Software date	S32	Date when program was created.		
Order	S33	Order number (6 digits)	Order&part (10 digits) is an unambiguous unit no.	
Part	S34	Serial four-digit number		
Version	S35	Not assigned.		
IFM identification	S36	Date, version and designation of the bus option (hardware module)		
Unit designation	S37	COMPAX P1XXM: 80 COMPAX 05XXM: 170 COMPAX 25XXS: 4	COMPAX P1XXM N1: 90 COMPAX 15XXM: 500 COMPAX 45XXS: 6	COMPAX 02XXM: 85 COMPAX 35XXM: 1000 COMPAX 85XXS: 5
Unit family	S38	e.g. "00": COMPAX XX00 "30": COMPAX XX30 ...		
Unit	S39	"0": COMPAX E "1": COMPAX-M "2": COMPAX-S "9": SV drive		
Status values	S40	Number of the status value present		

Special COMPAX XX00 status values

Designation	Status no.	Unit	Meaning
Velocity	S41	%	External velocity when using the SPEED SYNC command.
Encoder position	S42	P90	External position when using external position management.
Measuring error	S47	P90	During external position management: difference between resolver position and encoder position.
Present nominal value	S49	P90	Present internal nominal value (output of nominal value setter and/or track nominal value directly specified by HEDA).

Meaning of status bits

The status bits are not relevant for normal operation; they must not be used for control purposes. They do however allow for an accurate error analysis if you contact HAUSER should problems occur. - The bits are counted from the left to the right.

S23, S24, S25

Bit	Drive status (S23)	Switch status (S24)	Limits status (S25)
	-1111-----1111-	-111-111-110 ³⁵ ..	-11--11--11--11-
1 (left)	not assigned	not assigned	not assigned
2	Drive not at standstill	Override function	reserved
3	Deceleration phase	Limit switch 2 (-) activated	reserved
4	Acceleration phase	Limit switch 1 (+) activated	not assigned
5	Speed reached (speed regulation)	not assigned	not assigned
6	not assigned	not assigned	No motor current
7	not assigned	Zero initiator activated	
8	not assigned	reserved	not assigned
9	not assigned	reserved	not assigned
10	not assigned	not assigned	Position not OK.
11	not assigned	not assigned	Lag error
12	Speed reached (positioning)	reserved	not assigned
13	Positioning process complete	Do not change data record (emergency stop)	not assigned
14	Drive blocked	reserved	Speed limit reached
15	Machine zero reference available	not assigned	Current limit reached
16 (right)	not assigned	not assigned	not assigned

Output of status bits via the front plate

The status bits are output via the front plate using the 2 hex values.

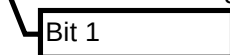
S16, S17

S16:			
Bit	Meaning		
1	="1": no interruption ="0": errors E1 ... E58; drive does not accept any positioning commands. After "Power on", bit 1 remains at "0" until the self-test has been performed.		
2	="1": no warning ="0" errors ³ E58		
3	Machine zero has been approached		
4	Ready for start		
5	Programmed nominal position reached		
6	Idle after stop		
7, 8	Bit 7	Bit 8	
	0	0	after OUTPUT O0 = "0"
	1	0	after OUTPUT O0 = "1"
	0	1	after OUTPUT O0 = "2"
S17:			
Bit	Meaning when "1"		
1	Password 302 active		
2	Service password active		
3	Command active; move commands (POSA, POSR; speed in speed control mode) are rejected using E92.		
4	Program memory running		
5	Stop via input I6		
6	reserved		
7	RUN ("0" = OFF or switched off when error occurs)		
8	---		

Bit sequence during transmission of S16 / S17:

Bit 1 is at the left (the transmission starts with bit 1)

E.g.: S17= "1000 0000" during ASCII transfer.



COMPAX front plate: display "01"

E.g.: password 302 active S17 = 0x80 (if all other bits ="0").

Explanation of error history S18

The errors which occur are recorded by COMPAX in an 8-stage sliding scale. The entire contents of this memory can be read using a status query. Once the error has been acknowledged, an "99" is inserted. Once a new error occurs, this is inserted in the sliding memory.

When querying using S18, the contents of the sliding scale are output and separated by spaces.

Once the unit is switched off, S18 is retained. If the unit is switched off while an error is present, a Power On acknowledgement is created when the unit is switched on, i.e. a "98" is inserted in the sliding memory.

Example: S18C_{RL}_F
Response: S018: 99 55 10 99 53 98 10 99C_{RL}_R>

- ◆ The last error, an emergency stop (E55) has been acknowledged.
 - ◆ E10 occurred before this (E10 has not been acknowledged).
 - ◆ E53 has been acknowledged.
 - ◆ E10 has been acknowledged by Power on.
- The error memory is completely reset to "00" by the reset parameter, i.e. "00" means no errors.

³⁵ The "0" is not shown in the front plate.

Status monitor S15

You can assign the values of the service D/A monitor to status S15 using parameter P182.

Selection of status value using P182

P182	Measuring parameter	Reference parameter
0	Speed nominal value sensor	20 000 rpm
1	Lag error	128 motor revolutions
2	Advance speed control	20 000 rpm
3	Nominal speed value of position controller	20 000 rpm
4	Actual speed value	20 000 rpm
5	Loop difference for speed	20 000 rpm
6	not assigned	
7	not assigned	
8	Nominal value of transverse current (torque) ³⁶	A200
9	Intermediate circuit voltage	1000V
10	Sine for the co-ordination transformation	
11	Voltage positioning signal for phase U	
12	Voltage positioning signal for phase V	
13	Phase current for phase U	A200
14	Phase current for phase V	A200
15	Actual value of transverse current (torque) ³⁷	A200
16	Longitudinal current	A200
17	Standardized transverse voltage (For amplification of 1 use: $10V = 2 \cdot U_{LS}$)	$2 \cdot U_{LS}$
18	Standardized longitudinal voltage (For amplification of 1 use: $10V = 2 \cdot U_{LS}$)	$2 \cdot U_{LS}$

The reference parameter corresponds to value 1.

Note concerning status monitor S15

Normalizing status monitor S15:

S15 does not have the same standardization as S13/S14.

For S15 use: S15=1 for the reference value which is given for the D/A monitor.

9.2 Additional COMPAX measured parameters

D/A monitor channels 0 ... 3 Status monitor S15 (P182)		
Selection	Measuring parameter	Ref. value
0	Speed nominal value sensor	20 000 rpm
1	Lag error	128 motor revolutions
2	Advance speed control	20 000 rpm
3	Speed nominal value of position controller	20 000 rpm
4	Actual speed value	20 000 rpm
5	Loop difference for speed	20 000 rpm
6	not assigned	
7	Speed controller output (nominal current value)	A200
8	Nominal value of transverse current (torque)	A200
9	Intermediate circuit voltage	1000V
10	Sine for the coordinate transformation	
11	Voltage positioning signal for phase U	$2 \cdot U_{LS}$

Signal indicators (optimization display) S13 / S14 (P233/P234)	
Selection	Meaning
1	Positioning time (from start of positioning to "position reached")
2	Max. intermediate circuit voltage in [V]
3	reserved
4	Max. undershoot referenced to max. position (amount) (only for highly misadjusted loops)
5	Max. position overshoot [units corresp. P90] (amount)
6	Max. position undershoot [units corresp. P90] (amount)
7	Max. acceleration lag error [units corresp. P90]
8	Max. braking lag error [units corresp. P90]
9	Max. acceleration speed in [%] of the nominal motor speed
10	Max. braking speed in [%] of nominal motor speed
11	Max. acceleration current in [%] of nominal motor current

³⁶ to determine the torque: torque = $3 \cdot \text{transverse current} \cdot 0.71 \cdot \text{torque constants}$

³⁷ to determine the torque: torque = $3 \cdot \text{transverse current} \cdot 0.71 \cdot \text{torque constants}$

[illegible]

Signal indicators (optimization display) S13 / S14 (P233/P234)		
Selection	Meaning	
17	Total number of HEDA transmission errors since beginning of synchronization	
18	Process nominal value HEDA	
19	HEDA control word	
20	HEDA status word	
21	CPX X50 max. pos. synchronous lag error [units corresp. P90]	
22	CPX X50 max. neg. synchronous lag error [units corresp. P90]	
23	Output value of D/A monitor channel 1 (10V corresponds to 1)	
24	Output value of D/A monitor channel 2 (10V corresponds to 1)	
25	Output value of service D/A monitor channel 3 (10V corresponds to 1)	
26	Output value of service D/A monitor channel 4 (10V corresponds to 1)	
27	External encoder position (units corresp. P90)	
28	Measuring error (difference between resolver position and external encoder position in the unit corresp. to P90)	
29	Effective motor load in % of the permitted continuous motor load (error message E53 is reported as of 100%)	
30	Effective unit load in % of permitted continuous unit load (error message E53 is reported as of 100%)	
	Variants	Reference values
	7x	$10V = 2^{23}$
	7x	$10V = 2^{23}$ per mil
	7x	$10V = 2^{23}$ cycles
	00,60,7x	$10V = 2^{23}$ ms
	00,60,7x	$10V = 2^{23}$
	00,60,7x	$10V = 2^{23}$
	60,7x	$10V = 2^{23}$ encoder increments/ms
		$10V = 2^{23}$ encoder increments/ms
39	Cause for calculation error E07	
	60,7x	$10V = 2^{23}$ encoder increments
	60,7x	$10V = 2^{23}$ encoder increments/ms
	7x	$10V = 2^{23}$ encoder increments/ms
	7x	$10V = 2^{23}$ encoder increments
	00,60,7x	$10V = 128$ motor revolutions
	00,60,7x	$10V = 128$ motor revolutions
	00,60,7x	$10V = 2^{22}$ increments/ms
47	Mark position (units corresp. P90) (COMPAX XX70)	
48		
49		
50	P-component position loop (reserved)	
51	P-component speed loop (reserved)	
52	I-component speed loop (reserved)	
53	D-component speed loop (reserved)	
54	P-component current loop (reserved)	
55	I-component current loop (reserved)	
56	Square of motor – peak current (reference value: 80 000A ²)	
57		
58		
59	Display of status monitor	
60	Sensor designation SinCos	
61	Value read acyclically by S1 option	
62	1st cyclic channel of S1 = position (100 microns) (reference: 2^{-24} revolutions)	
63	2nd cyclic channel of S1 (1 ms)	
64	3rd cyclic channel of S1 (1 ms)	
65	Absolute value from S2 option in format 12:12, limited by 0 ... P96 (reference: 1 revolution = 4096)	
66	Absolute value from S1 option, not limited (reference: 2^{-12} revolutions)	
67	Additional error numbers in E42	
68	Option designation / SW version number (S1 / S2_option)	

9.3 COMPAX parameters

9.3.1 VP parameter can be modified ³⁸ "On line"

VP parameters can be modified and transferred and the password can be specified no matter which operating mode COMPAX is using.





Note!

Note the following points.

1. Processor load

When parameters are being validated using the "VP" command, the response time and/or time required to perform commands is temporarily extended due to the burden on computing time.

e.g. at the time the parameters are transferred, a "Stop signal" is recognized after a short delay.

Typical delay times would be:

range of parameters: P1 ... P79: approx. 0.5 ms per parameter.

>P79: approx. 20 ms.

2. Modifying the controller setting

When modifying the controller setting via parameters P23, P24, P25, P26, P27 or P70, comparison processes may arise. These can then be recognized as brief axis feedback control operations. Therefore: only modify parameters in small steps when the axis is active.

3. Area of application

This extension to the function is used for the start-up and for optimizing the axis. It is not intended for the implementation of control tasks.



Please note: the axis must be switched off when you transfer modified VC parameters (e.g. via OUTPUT O0=1)!

9.3.2 COMPAX standard parameters

Parameter sub-division:

Control parameters	P40 ... P49
Limitations	P11 ... P16
Bus parameters	P135 ... P142; P190 ... P196
D/A monitor, status monitor S15	P71 ... P74, P76, P77, P182
Inputs/outputs: assignment / meaning	P18, P211, P221, P223, P224, P225, P227, P245, P246
Defining encoder interfaces(option)	P75, P98, P143, P144, P146, P232
Substitue and specification values:	P1 ... P10
HEDA	P181, P184 ... P188, P243, P247 ... P250
Configuration parameters	P80 ... P85, P88, P90, P92, P93, P98
Mark reference	P35, P37, P38, P39
Defining mechanical reference system	P29, P206, P212 ... P217,
Motor parameters	P100 ... P133
Optimization parameters, optimization display	P21 ... P27, P50, P67 ... P70, P94, P151, P233, P234
Parameters of software variants	P30 ... P39
RS232	P19, P20
Other parameters	P17, P218, P219, P229
SPS data interface	P18

◆ Parameters not described here are reserved.

³⁸ VP means "Valid Parameter" and is a COMPAX command with which COMPAX transfers the modified parameter of a particular parameter group. The VP parameters are marked in the following parameter lists in the column "Valid as of...".

COMPAX standard parameters

Remark

The specified limit values refer to all parameters. Theoretical combinations are, however, possible within these limits, yet they could cause an internal number overrun. The following limitation applies.

The travel per motor revolution must be greater than 0.01 mm or with increment unit: > 10 increments.

Travel per motor revolution:

- ◆ spindle drive: P83;
- ◆ rack-and-pinion/toothed belt P82*P83;
- ◆ general drive: P83 (/1000 in mm)

List of parameters, sorted by number

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of..
P1	Point of real zero (distance between real zero and machine zero).	corresp.P90	- 1 000 000	0.00	+1 000 000	immediately
P2	Substitute for non-programmed velocity.	%	1.00	10.00	100.00	immediately
P3	Velocity for find machine zero.	%	-100.00	10.00	100.00	immediately
P4	Velocity for approach real zero.	%	1.00	10.00	100.00	immediately
P5	Velocity for processing by hand.	%	1.00	10.00	100.00	immediately
P6	Substitute value for non-programmed ramp time.	ms	1	1000	60 000	immediately
P7	Ramp time for approach machine zero.	ms	1	1000	60 000	immediately
P8	Ramp time for approach point of real zero.	ms	1	1000	60 000	immediately
P9	Ramp time for processing by hand.	ms	1	1000	60 000	immediately
P10	Ramp time once limit switch has been activated.	ms	1	250	60 000	immediately
P11	Max. positive position referenced to machine zero.	corresp.P90	P12	+4 000 000.00	+4 000 000.00	VP
P12	Max. negative position referenced to machine zero.	corresp.P90	-4 000 000.00	- 4 000 000.00	P11	VP
P13	Max. permitted lag tolerance (error E10 is triggered when exceeded); E10 & E49 are switched off with specification "0".	corresp.P90 or % of P104 ³⁹	0	10.00	4 000 000.00	VP "0" immediately
P14	Max. permitted positioning zone (applies for message O5 : "position reached")	corresp.P90 or % of P104 ⁴⁰	0.00	1.00	4 000.00	VP
P15	Max. permitted velocity	%	0.00	100.00	100.00 ⁴¹	VP
P16	Max. permitted torque	% of P105	0	200	300	VP
P17	Engine brake delay	ms	0	0	4000	VP
P18	SPS data interface Fast start via I15 Fast start via HEDA Note! Settings with bit 1 and bit 3 are only permitted in COMPAX XX00.	Bit 0 ⁴² =0 without SPS data interface =1 with SPS data interface Bit 1 =0 fast start on I15 not active =1 fast start on I15 active Bit 3 =0 no fast start on HEDA =1 fast start on HEDA active only permitted on P18 when bit 1=1.				VP
P19	RS232 Baud rate	Bit/s	4800	9600 ⁴³	9600	Power on

³⁹ In speed control mode in % of nominal speed (P104), otherwise corresponds to P90

⁴⁰ In speed control mode in % of nominal speed (P104), otherwise corresponds to P90

⁴¹ For asynchronous motors, the maximum permitted velocity may be up to 300% of the nominal velocity.

⁴² Counting in bits, starting with bit 0.

⁴³ By simultaneously pressing the three front plate keys when switching on, the Baud rate is set to 9600.

No.	Meaning		Unit	Minimum value	Default value	Maximum value	Valid as of..
P20	RS232 handshake P20 setting. The sum of the specified values is entered in P20.	Software handshake	"0": without "1": with XON, XOFF				Power on
		Error transmission / negative command acknowledgement (E90 - E94)	"0": error only when there is activity on the interface and if the transmitted command triggers an error. No neg. command acknowledgement (E90 - E94). "2": no transmission of error and no neg. command acknowledgments (E90 - E94). "4": errors and negative command acknowledgments (E90 - E94) are reported once they arise using Exx CR LF >. "6": errors & neg. command acknowledgement (E90 - E94) only when there is activity on the interface.				immediately
		End sign selection	"0": $C_R \cdot L_F >$ "8": C_R				Power on
		Binary transfer	"0": without "16": with				immediately
		BCC: block check EXOR of all signs apart from the end sign	"0": without "128": with				Power on
P21	Factor for influencing the travel per motor revolution			0.1000	1.0000	10.0000	VP&VC
P22	Factor for modifying the speed which is allocated to speed SPEED 100%. ⁴⁴			0.5000	1.0000	2.0000	VP&VC
P23	Rigidity of drive		%	10	100	5000	VP
P24	Speed controller damping		%	0	100	500	VP
P25	Advance control speed value		%	0 ⁴⁵	100	500	VP
P26	Advance control acceleration value		%	0	100	500	VP
P27	Moment of inertia		%	10	100	500	VP
P29	–Machine zero comparison		Degree	0	0	360	VP
P35	Switching on mark reference		"0": switched off "1": switched on				VP
P36	Limitation of speed correction value for external position adjustment (only available in COMPAX XX00 and COMPAX XX30) = "0": switched off		% of nominal speed (P104)	0	0	100	VP
P37	Minimum travel to mark		corresp.P90	0.00	0.00	<P38	VP
P38	Maximum travel to mark		corresp.P90	>P37	0.00	4 000 000,00	VP
P39	Maximum feed length		corresp.P90	≥P38	0.00	<P11 or P12	VP
P40	Control parameter			-4 000 000	0	+4 000 000	immediately
P41	Control parameter			-4 000 000	0	+4 000 000	immediately
P42	Control parameter			-4 000 000	0	+4 000 000	immediately
P43	Control parameter			-4 000 000	0	+4 000 000	immediately
P44	Control parameter			-4 000 000	0	+4 000 000	immediately
P45	Control parameter			-4 000 000	0	+4 000 000	immediately
P46	Control parameter			-4 000 000	0	+4 000 000	immediately
P47	Control parameter			-4 000 000	0	+4 000 000	immediately
P48	Control parameter			-4 000 000	0	+4 000 000	immediately
P49	Control parameter			-4 000 000	0	+4 000 000	immediately

⁴⁴ When motor nominal speeds have been modified, use this factor to perform a simple adaptation to the present program.

⁴⁵ When P93 = 4, P25 must >0.

COMPAX standard parameters

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of..
P50	Turning on speed monitor (=101)	=100: without monitor (standard setting) =101: with monitor				VP
P67	D-element slip filter	%	0	100	500	VP
P68	Delay slip filter	%	0	100	5000	VP
P69	Advance control ("0" : without advance control)	%	0	0	500	VP
P70	Advance control current value	%	0	0	500	VP
P71	D/A monitor 1 amplification		1	5	4 000 000	VP
P72	D/A monitor 2 amplification		1	10	4 000 000	VP
P73	Address of D/A monitor 1		0	4	18	VP
P74	Address of D/A monitor 2		0	15	18	VP
P75	Max. permitted measuring error (difference between resolver position and external encoder position). The external position management is switched on and the internal position is corrected with a measuring error ≠ 0.	P90	0	0	4 000 000	VP
P76	Address of D/A monitor 3 (decimal place =0 ≡ amplification 1)		0	4 000 000 1	20 000	VP
P77	Address of D/A monitor 4 (decimal place =0 ≡ amplification 1)		0	15 000 000 1	20 000	VP
P80	Drive type	"2": spindle drive "4/8": rack-and-pinion/toothed belt "16": gen. drive				VC
Drive type "Spindle drive" (P80="2")						
P81	Length	mm	300	0.00	5000.00	VC
P82	Diameter	mm	8.00	0.00	80.00	VC
P83	Pitch	mm	1.00	0.00	400.00	VC
P84	Moment of inertia for transmission and coupling	kgcm ²	0.00	0.00	200.00	VC
P85	Ratio		10 000 000	10 000 000	1000 000 000	VC
P88	Max. translated mass moved	kg	0		500	VC
P92	Min. translated mass moved	kg	0		P88	VC
"Rack-and-pinion/toothed belt" drive type (P80="4/8")						
P82	Tooth number		Tooth number * tooth pitch = 1.00 410.00			VC
P83	Tooth pitch	mm				VC
P84	Moment of inertia of transmission and coupling	kgcm ²	0.00	0.00	200.00	VC
P85	Ratio		10 000 000	10 000 000	1000 000 000	VC
P88	max. translated mass moved	kg	0		500	VC
P92	min. translated mass moved	kg	0		P88	VC
"General drive" drive type (P80="16")						
P81	Min. total moment of inertia	kgmm ²	0.00	0.00	Jmax.(82)	VC
P82	Max. total moment of inertia	kgmm ²	0	0.00	200 000	VC
P83	Travel per motor revolution	mm or incred.	10	0.00	4 000 000 _{mm} 65 536 _{incr.}	VC
P90	Unit for travel	"0": increments "1": mm "2": inch				VC
P93	Operating mode	"1": normal mode "2": continuous mode "4": speed control mode ⁴⁶				47
P94	Ramp shape	"1": linear "2": smooth "3": quadratic.				48

⁴⁶ When in speed control mode, P25 must > 0.⁴⁷ As of next process command

No.	Meaning		Unit	Minimum value	Default value	Maximum value	Valid as of..
P96	Transmission factor for the reset route of S2 option. ="0": no reset function.		-	0	0	4095	VC
P98	Axis travel per encoder revolution		corresp.P90	0	0	4 000 000	VC
No.		Valid for ⁴⁹					
P100	Motor number		Motor selection				VC
P101	Number of terminals	A,S		2	2	12	VC
P102	EMC	S	V*min/ 1000	10		400	VC
P103	Moment of inertia	A,S	kgmm ²	0		200 000	VC
P104	Nominal speed	A,S	rpm	500		9000	VC
P105	Nominal current	A,S	mA	200		100 000	VC
P106	Nominal torque	A,S	mNm	0		100 000	VC
P107	Pulse current	A,S	%	100		400	VC
P108	Max. time in current limit (P16)	A,S	ms	1000		5000	VC
P109	Stand inductivity	A,S	μH	0		200 000	VC
P110	Magnetization current	A	mA	100		0.7*P105	VC
P111	Rotor time constants	A	ms	5		2000	VC
P112	Slip frequency	A	mHz	100		20 000	VC
P113	Maximum speed	A,S	rpm	0		9000	VC
P115	Angular speed	A	% of P104	50	100	200	VC
P116	Stand resistance	A,S	mOhm	0		150 000	VC
P119	Start of saturation	S	%	70	100	< P120	VC
P120	End of saturation	S	%	> P119	400	400	VC
P121	Minimum stand inductivity	S	% of P109	10	100	100	VC
P122	Main inductivity	A	μH	0		2 000 000	VC
P123	Rotor scatter inductivity	A	μH	0		200 000	VC
P124	Rotor resistance	A	mOhm	0		10 000	VC
P125	Nominal voltage	A	V	10		400	VC
P128	Cut-off value of temperature sensor for E48	A,S	Ohm	0	0	20 000	VC
				"0": HDX / HDY – motors "1270": HJ – motors			
P129	Resolver offset	A,S	Degree	0	0	360	VC
P130	Resolver frequency	A,S	"1":3 kHz(P1) "2":5 kHz(P4)				VC
P131	Resolver transformation ratio	A,S	"1":(P1) "2":0.5 (P4)				VC
P132	Position sensor	A,S	"2": 2-pin resolver (P1,P4)				VC
P133	Sensor dash count	A,S	65 536				VC
P135 - P142		Bus parameter					
P143	Encoder pulses per revolution (channel 1)			128	4096	2 000 000	VC
P144	Setting encoder channel 1		="4": without external position management ="6": external position management switched on via channel 1.				VC
P146	Resolution of encoder emulation (channel 2)		=0: 1024 =8: 512 (fixed for SinCos)				VC
P148	End stage designation		"Read only" – parameter ≡ S37				
P149	Configuration		"0": not valid "1": valid ⁵⁰				VC

⁴⁸ as of next process command⁴⁹ A: parameter for asynchronous motors
S: parameter for synchronous motors

COMPAX standard parameters

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of..
P151	Responsiveness of the monitor control	%	0	30	500	VP
P181	HEDA parameter: coupling window (µm or increments)		0	10	4 000 000	VP
P182	Setting status monitor S15		0	0	532 767	VP
P184	Selection parameter for HEDA process value (master) Standard value: P184 = 0	40: encoder position 42: internal time base 43: standardized master position 44: nominal position value in resolver increments 45: actual position value in resolver increments 46: differentiated resolver position				VP
P185 - P187	HEDA parameter					
P188	Selection parameter for HEDA process value (slave) Standard value: P188 = 0	40: encoder coupling for encoder input signals (P184=40) 140: encoder coupling for other input signals (P184≠40) 42: internal time base 43: standardized master position				VP
P191 - P196	Bus parameter					
P197	Order (status S33)	"Read only" parameter				
P198	Part (status S34)	"Read only" parameter				
P199	Serial number (status S35)	"Read only" parameter				
P206	Approval of absolute value sensor input or the reset function for the S2 option	="1": absolute value sensor input approved or reset function switched on.				VP
P211	Blocking and modifying the teach in function	"0" The teach data record and teach real zero functions are approved. "1" Teach in real zero is blocked, data record indicator is set to 1 using I1 + I4 . "2" Teach in data record is blocked, data record indicator is set to 1 using I1 + I5. (Teach real zero is approved) "3" The teach data record and teach in real zero functions are blocked. For I1 + I4 , teach N and/or I1 + I5, data record indicator is set to 1.				immediately
P212	Machine zero mode	"0": MN equals external initiator & resolver zero / 2 reversing initiators. "1": MN equals external initiator & resolver zero. "3": MN equals external zero pulse "4": MN equals external initiator & external zero pulse. "5": MN equals resolver zero "6": reserved "7": MN equals external initiator (without resolver zero). "8": MN equals limit switch "10": teaches machine zero				immediately
P213	Machine zero direction	"0": to the right "1": to the left				VP
P214	Encoder direction	"0": positive direction when encoder is turning clockwise. "1": positive direction when encoder is turning anti-clockwise.				VP
P215	Direction of rotation	"0": motor to the right "1": motor to the left				VP

50 When P149="0", all parameters apart from the bus settings P194, P195, P196, P250 are set to standard values when switched on.

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of..
P216	Limit switch position E1 is approached when ...	"0": motor turning clockwise "1": motor turning anti-clockwise				immediately
P217	Limit switch mode	"0": without "1": with limit switch				immediately
P218	Error cutout Standard value: P218=0 (E57 active and E65 not active)	Bit 0 ="0" E57 active ="1" E57 switched off Bit 1 ="0" E65 switched off ="1" E65 active				immediately
P219	Emergency stop input on COMPAX-M / Synchronous STOP on COMPAX XX00	=0 no evaluation of emergency stop input on COMPAX-M =7 emergency stop input on COMPAX-M active =128 synchronous STOP on COMPAX XX0X and no evaluation of emergency stop input on COMPAX-M =135 synchronous STOP on COMPAX XX0X with evaluation of emergency stop input on COMPAX-M				VP
P221	Freely assigning standard inputs with a "1"	Input (valency) [bit no.]: I1 (1) [1] • I2 (2) [2] • I3 (4) [3] I4 (8) [4] • I5 (16) [5] • I6 (32) [6] P221 = sum of valencies of all free inputs you want.				immediately
P223	Assigning outputs O1 - O8 to the OUTPUT WORD command with a "1"	Output (valency) [bit no.]: O1 (1) [1] • O2 (2) [2] • O3 (4) [3] • O4 (8) [4] O5 (16) [5] • O6 (32) [6] • O7 (64) [7] • O8 (128) [8] P223 = sum of valencies of the OUTPUT WORD outputs				immediately
P224	Assigning outputs O9 - O16 to the OUTPUT WORD command with a "1"	Output (valency) [bit no.]: O9 (1) [1] • O10 (2) [2] • O11 (4) [3] • O12 (8) [4] O13 (16) [5] • O14 (32) [6] • O15 (64) [7] • O16 (128) [8] P224 = sum of valencies of OUTPUT WORD outputs				immediately
P225	Freely assigning standard outputs with a "1"	Output (valency) [bit no.]: O1 (1) [1] • O2 (2) [2] • O3 (4) [3] O4 (8) [4] • O5 (16) [5] • O6 (32) [6] P225 = sum of valencies of all free outputs you want.				immediately
P227	Assigning special functions to outputs	Bit 1 ⁵¹ ="0": O2 is assigned standard function (=no warning). Bit 1="1": O2 is assigned with "Idle display" function. Bit 4="0": O5 is assigned standard function (position reached with evaluation of P14) Bit 4="1": O5 is assigned function O5, toggles when position reached.				immediately
P229	Speed threshold for "idle indicator" function (only switched on if P227 bit 1="1")	☐	0	0	255	VP
P232	Controlling external position adjustment using I11	=0: I11 can be freely assigned =4: I11 switches the external position adjustment (I11="0": switched off and I11="1": switched on)				
P233	Setting the optimization display S13	1...255				immediately
P234	Setting the optimization display S14	1...255				immediately
P243	HEDA operation mode	="0": single axis (when P250=0) or slave on IPM (P250=1 ... 9) ="1": COMPAX as master ="2": COMPAX as slave on a COMPAX master				VP
P245	Allocating outputs O1 - O8 to the HEDA bus	Output (valency) [bit no.]: O1 (1) [1] • O2 (2) [2] • O3 (4) [3] • O4 (8) [4] O5 (16) [5] • O6 (32) [6] • O7 (64) [7] • O8 (128) [8] P245 = sum of valencies of the outputs allocated to the HEDA bus				immediately
P246	Allocating outputs O9 - O16 to the HEDA bus	Output (valency) [bit no.]: O9 (1) [1] • O10 (2) [2] • O11 (4) [3] • O12 (8) [4] O13 (16) [5] • O14 (32) [6] • O15 (64) [7] • O16 (128) [8] P246 = sum of valencies allocated to the HEDA bus				immediately
P247 - P250	HEDA parameter					VP

⁵¹ Counting in bits starting with bit 0.

9.3.3 Special parameters

1.1.1.1 RS485 interface (option F1/F5)

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of...
P194	Address of unit		0	99	31	Power on
P195	Baud rate: for field bus protocol (P196 = 164)	Bit/s	150	9600	115 200	Power on
		Bit/s	28 800 · 57 600 · 172 800 · 345 600			
P196	Operating mode		0	0	255	Power on

9.3.3.2 CAN bus (option F4)

No.	Meaning	Minimum value	Default value	Maximum value	Valid as of.
P192	Realigning priority	0x000 000	0xFFCF4C = -12 468	0xFFFFF	VP
P193	Reporting events automatically.	0	0	255	immediately
P194	Address of unit	0	99	99	VP
P195	Baud rate. Possible settings (in Baud): 20 000 • 50 000 • 100 000 • 125 000 • 250 000 • 500 000 • 800 000 • 1 000 000	0	9600	1 000 000	Power on
P196	Permanent setting: ="192"	192	192	192	Power on

9.3.3.3 Profibus (option F3)

No.	Meaning	Minimum value	Default value	Maximum value	Valid as of...
P191	Bus time-out	="0": no response when a time-out occurs (E73 is reported) ="1": stop with E73 and shut down with activation of holding brake.			VP
P193	Pop-up messages	=1: automatic error message =2: automatic "position reached" message =4: automatic reporting of comparator shift points			immediately
P194	Address of units	0	99	126	Power on
P196	Operating mode	0	0	255	Power on
P135	Index and subindex of object which occupies the 1st PE data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P136	Index and subindex of object which occupies the 2nd PE data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P137	Index and subindex of object which occupies the 3rd PE data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P138	Index and subindex of object which occupies the 5th PE data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P139	Index and subindex of object which occupies the 1st PA data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P140	Index and subindex of object which occupies the 2nd PA data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P141	Index and subindex of object which occupies the 3rd PA data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P142	Index and subindex of object which occupies the 5th PA data byte after power on. Value: Index • 256 + Subindex	0	0	16 777 215	Power on
P203	Assigning status S16 and S17 to CPX_ZSW	Bit 0 ="0" CPX_ZSW (standard assignment) Bit 0 ="1" S16, S17 to CPX_ZSW			immediately

9.3.3.4 Interbus S (option F2)

No.	Meaning	Minimum value	Default value	Maximum value	Valid as of ...
P190	Sets "DRIVECOM profile 22" operating mode	="0": "DRIVECOM profile 22" operating mode is inactive ="22": "DRIVECOM profile 22" operating mode is active			Power on
P191	Bus time-out	="0": no response, except error message E73, during a time-out ="1": stop with E73 and shut down during activation of holding brake			VP
P193	Pop-up messages	="1": automatic error message ="2": automatic "Position reached" message ="4": automatic reporting of comparator shift points			immediately
P196	Process data length	= "0" or "1": 2 bytes (1 word) = "2": 4 bytes (2 words) = "3": 6 bytes (3 words)			Power on
P135	Index and subindex of object which occupies the 1st PE data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on
P136	Index and subindex of object which occupies the 2nd PE data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on
P137	Index and subindex of object which occupies the 3rd PE data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on
P138	Index and subindex of object which occupies the 5th PE data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on
P139	Index and subindex of object which occupies the 1st PA data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on
P140	Index and subindex of object which occupies the 2nd PA data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on
P141	Index and subindex of object which occupies the 3rd PA data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on
P142	Index and subindex of object which occupies the 5th PA data byte after power on. Value: Index • 256 + Subindex	0	0	16777215	Power on

9.3.3.5 CANopen (option F8)

No.	Meaning	Minimum value	Default value	Maximum value	Valid as of ...
P190	Sets "Device profile DSP 402" operating mode	="0": "DSP402 " operating mode inactive ="22": "DSP402 " operating mode active			Power on
P191	Bus time-out	="0": no response, except error message E73, during a time-out ="1": stop with E73 and shut down during activation of holding brake			VP
P193	Pop-up messages	="1": automatic error message ="2": automatic "Position reached" message ="4": automatic reporting of comparator shift points			immediately
P194	Address of unit	0	99	99	VP
P195	Baud rate. possible settings (in Baud): 20 000 • 50 000 • 100 000 • 125 000 • 250 000 • 500 000 • 800 000 • 1 000 000	0	9600	1 000 000	Power on
P196	Protocol	Bit 0 = 0 pop-up messages are reported with EMCY Bit 0 = 1 pop-up messages are displayed in the status word Bit 1 = 0 boot-up object with 0 data byte Bit 1 = 1 boot-up object structure as EMCY; data=0 Bit 2 = 0 boot-up object only transmitted after Power on Bit 2 = 1 boot-up object also transmitted after a START message			Power on
P135	Index and subindex of 2nd object on the TPDO1 after power on*.	0	0	16777215	Power on
P136	Index and subindex of 3rd object on the TPDO1 after power on*.	0	0	16777215	Power on
P137	Index and subindex of 1st object on the TPDO2 after power on*.	0	0	16777215	Power on

* value to be entered=index*256+subindex

Special parameters

No.	Meaning	Minimum value	Default value	Maximum value	Valid as of ...
P138	Index and subindex of 2nd object on the TPDO2 after power on*.	0	0	16777215	Power on
P139	Index and subindex of 2nd object on the RPDO1 after power on*.	0	0	16777215	Power on
P140	Index and subindex of 3rd object on the RPDO1 after power on*.	0	0	16777215	Power on
P141	Index and subindex of 1st object on the RPDO2 after power on*.	0	0	16777215	Power on
P142	Index and subindex of 2nd object on the RPDO2 after power on*.	0	0	16777215	Power on
P203	Assigning status S16 and S17 to CPX_ZSW	Bit 0 ="0" CPX_ZSW (standard assignment) Bit 0 ="1" S16, S17 to CPX_ZSW			immediately

9.3.3.6 Option A1 / A3 "HEDA"

No.	Meaning	Minimum value	Default value	Maximum value	Valid as of...
P181	Coupling window (in microns or increments)	0	10	4 000 000	VP
P184	Selection parameter for HEDA process value (master) Standard value: P184 = 0	40: encoder position 42: internal time base 43: standardized master position 44: nominal position value in resolver increments 45: actual position value in resolver increments 46: differentiated resolver position			VP
P185	HEDA number channel 1 low	100 000	100 183	332 767	VP
P186	HEDA number channel 2 high	100 000	100 183	332 767	VP
P187	HEDA number channel 2 low	100 000	100 183	332 767	VP
P188	Selection parameter for HEDA process value (slave) Standard value: P188 = 0	40: encoder coupling at encoder input signals (P184=40) 140: encoder coupling at other input signals (P184≠40) 42: internal time base 43: standardized master position			VP
P247	Max. average transmission error	0	5	255	VP
P248	Maximum transmission error	0	15	255	VP
P249	Synchronization monitoring	0	10	50	VP
P250	Address of unit	0	0	255	VP

9.3.3.7 Round table control COMPAX XX30

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of...
P1	Point of real zero	Degree	-360.000	0	360.000	52
P75	Maximum measuring error	Degree	0.01	1.00	360.00	VP
P68	Measuring filter: <100%: upstream >100% downstream (filtering)	%	10	100	5000	VP
P80	Drive type	="16": general drive ="64": round table control				VC
P81	Minimum moment of inertia	kgmm ²	0	0	P82	VC
P82	Maximum moment of inertia	kgmm ²	0	0	200 000	VC
P83	Travel per motor revolution for general drives	$\frac{\text{Grad}}{1000}$	0	0	360 000	VC
P85	Transmission ratio for round table control drive type	-	1000 000		1000 000 000	VC
P90	Units for distance indication (supplemented)	"0": increments "1": mm "2": inches "3": degree (supplement); given in millidegrees (1/1000 degree) for "general drives"				VC
P93	Operating mode	"1": normal operation "2": continuous operation "3": reset mode (supplement) "4": speed control mode				immediately
P98	Travel per encoder revolution	Degree	360	360	360	VC
P143	Number of dashes of the external position measuring system		0	0	2 000 000	VC
P144	Channel 1 = external sensor		="6"			VC

9.3.3.8 Synchronous cycle control COMPAX XX50

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of...
P30	Minimum travel to mark	corresp.P90	0.00	0.00	100 000.00	VP
P31	Position of mark sensor referenced to machine zero initiator	corresp.P90	-10 000.00	0.00	100 000.00	VP
P32	Relative target position*	corresp.P90	P11	0.00	P12	VP
P33	Synchronous comparator	corresp.P90	0.00	0.00	100 000.00	VP
P34	Synchronous brake travel*	corresp.P90	-100 000.00	0.00	100 000.00	VP
P35	Synchronous start travel	corresp.P90	0.00	0.00	256 motor revolutions	VP
P36	Material simulation	%	0.00	0.00	100.00	VP
P37	Reject length	corresp.P90	0.00	0.00	100 000.00	VP
P38	Sawblade correction	corresp.P90	0.00	0.00	100 000.00	VP
P39	Beam angle	Old degree	0.00	0.00	80.00	VP

52 As of the next POSA or POSR positioning process.

When the pitch calculator is active, any modified real zeros will not be transferred. If you are using a new pitch calculator, you will require POSA or POSR.

Special parameters

9.3.3.9 Electronic transmission COMPAX XX60

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of...
P035	Transmission factor 1 (I15=0)		-200 000 000	0	200 000 000	VP
P036	Transmission factor 2 (I15=1)		-200 000 000	0	200 000 000	VP
P037	Speed ("1") angle - angle synchronicity ("0") When P37=0, P38 must be set to 1.		0	0	1	VP
P038	Synchronous time for speed changeover When P37=0, P38 must be set to 1.	ms	1	1	60 000	VP
P68 ⁵³	Filter for external advance speed control 0: filter switched off	%	0	0	550	VP

9.3.3.10 Electronical curve control COMPAX XX70

No.	Meaning	Unit	Minimum value	Default value	Maximum value	Valid as of
P30	Selecting master input	="0": coupled to master by means of an encoder ="1": not coupled to a master; simulation of master speed by an internal time base ≥10: the tens column specifies whether P35 is transferred as triggered				VP
P31	Operating mode I16 "Master position approval" (mark-referenced starting of counter)  The operating mode P31="2" is treated as P31="0" when operating with internal time base (P30="1").	="0": approval of master signals, statistically via I16. ="1": approval of master signals via I16 and flank-triggered with the encoder zero pulse. ⁵⁴ ="2": approval of master signals via a pulse on I16. Block with SETC n and I16="0". ="3": approval of master signals via a pulse on I16, only for a master cycle. Block at the end of the master cycle route when I16="0" (is triggered again when I16="1"). ="4": approval of master signals flank-triggered via I16. Block with SETC n ="5": approval of master signals flank-triggered via I16, only for a master cycle. ="9": static master position approval with I16 for HEDA coupling. HEDA coupling is also possible with P31="0".				VP
P32	Distance of mark sensor	Unit of the corresp. cycle route	0.000000	0.000000	10*M _T 10*S _T	VP & at the end of the active curve cycle
P33	Operating mode of mark synchronization	="0": no mark synchronization ="1": master-related mark synchronization ="2": slave-related mark synchronization			VP & next curve	
		="11": master-related mark synchronization; ="12": slave-related mark synchronization			VP & at end of active curve cycle	

⁵³ **Attention:** Only use filter P68, if quantization noises can be heard due to the low resolution in the master channel. Otherwise, set to 0 to reduce the lag error to a minimum.

⁵⁴ Operating mode not possible with HEDA coupling since the encoder zero pulse is not transferred.

No.	Meaning		Unit		Minimum value		Default value		Maximum value		Valid as of		
P34	Connection mode (Note: M _S and M _B are taken into consideration regardless of P34; if you do not want this to be the case, set M _S = M _B = 0;)		="0": without coupling and decoupling positions (bit 0="0"). ="1": with coupling and decoupling positions (bit 0="1"). ="2": exits curve mode after decoupling (bit 1="1") ="4": exits curve when loop counter terminates (LOOP n) at the end of the master cycle (bit 2="1"). The settings can be combined; the sum is then entered in P34.									VP & SETC	
P35	Factor in master input channel					-1000 000 000		1 000 000		1000 000 000		VP	
P36	Transmission factor					-1000 000 000		1 000 000		1000 000 000		VP and refer ⁵⁵ to	
P37	Reset value for digital auxiliary functions (Standard: 00000000)			O7	O8	O9	O10	O11	O12	O13	O14	VP	
P38	Mask for digital auxiliary functions (Standard: 00000000)			2 ⁶	2 ⁷	2 ⁸	2 ⁹	2 ¹⁰	2 ¹¹	2 ¹²	2 ¹³	VP	
P39	Ramp time of internal time base			ms		0		0		4 000 000		VP	
P68 ⁵⁶	Filter for external speed feed forward 0: filter switched off			%		0		0		550		VP	
P79	Lag zone (displayed via O15)			corresp. to P90		0		1		<P13		VP	
P90	Units for distance indication (supplemented)			"0": increments (supplement) "1": mm "2": inches "3": Degree (supplement); given in millidegrees for "General drive" (1/1000 degree)									VC
P93	Operation mode			"1": normal operation "2": continuous operation "3": reset mode (supplement) "4": speed control mode									immediately
P179	Ramp for P35			ms		0		0		4 mil.		VP	
P210	Parallel mode	"0": linear processing of the program memory (previous settings) "1": the program continues to run during a positioning process and remains at a standstill during the next positioning command Only the next but one positioning command is acknowledged negatively.										immediately	

The following parameters P80 to P88 apply for the "Roller feed" drive type

P80	Drive type		"32": Roller feed (supplement)			VC
P82	Moment of inertia of dressing rollers	kgcm ²	0	0	70 000	VC
P83	Circumference of the slave feed rollers	mm	30	30	3000	VC
P84	Moment of inertia of transmission and clutch with reference to the drive axis.	kgcm ²	0.00	0	200.00	VC
P85	Transmission ratio		10 000 000	10 000 000	1000 000 000	VC
P88	Translated mass moved	kg	0	0	500	VC

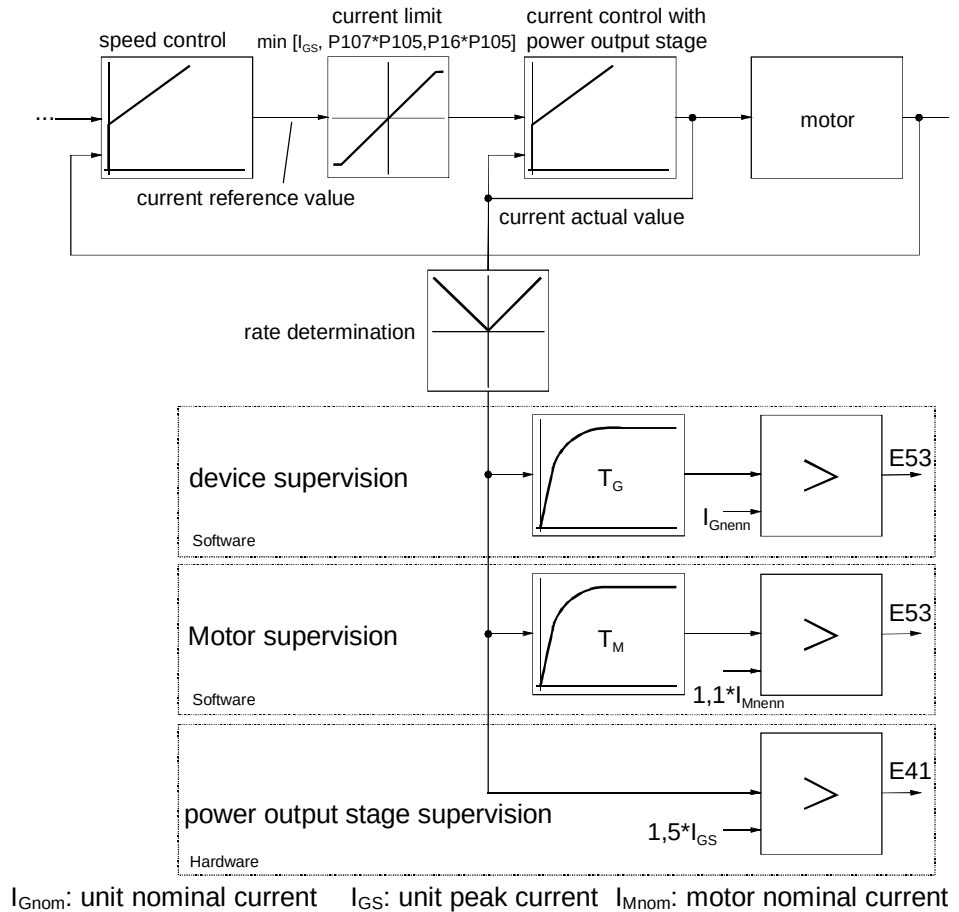
⁵⁵ P36, after VP, is only accepted at the next curve zero point or with SETC, and this ensures that no sporadic modification is made to the nominal position value. Curves with a slave value of $\neq 0$ at the curve zero point cannot prevent any sporadic modifications to the nominal position value.

⁵⁶ **Attention:** only use filter P68, if quantization noises can be heard due to low resolution in the master channel. Otherwise, set to 0 to reduce the tracking error to a minimum.

9.3.4 Monitoring and limitation characteristics

We want to use this section to provide you with more detailed explanations about the COMPAX monitoring and limitation characteristics.

Structural diagram:



Dynamic monitoring:

In COMPAX the nominal current value is limited to the smallest value of the following 3 parameters.

- ◆ I_{GS} : unit peak current
- ◆ $P105 \cdot P107$: nominal motor current (P105) * maximum pulse current permitted for the motor (P107)
- ◆ $P105 \cdot P16$: nominal motor current (P105) * maximum permitted (user-set) torque (P16)

Static monitoring

This contains three different types of monitoring

Unit monitoring

Using the unit-specific time constant T_G , a current greater than I_{Gnom} is permitted; after that E53 shuts the unit down.

Motor monitoring

Using the time constant T_M , a current greater than $1.1 \cdot I_{Mnom}$ is permitted for a defined time; after that E53 shuts the unit down. T_M is set to ensure that the pulse current P107 is able to flow for the time set in P108.

Final stage / short circuit monitoring Absolute monitoring to $1.3 \cdot I_{GS}$.

9.4 Error handling

- ◆ Messages are reported for all errors using the LED error on the front plate.
- ◆ An error message EXX appears in the display. You can modify the parameters when an error message is present.
- ◆ When you have rectified the cause of the error, you can acknowledge the error using Enter, Quit or by switching the unit on again (Power on).
- ◆ It is only once the LED (error) has gone out that COMPAX is ready for operation again.
- ◆ Switch off COMPAX if you are experiencing hardware errors (e.g. short circuit to outputs).
- ◆ The errors E1...E56 are also reported with the binary output O1="0"; the drive does not accept any positioning commands and the ready contact is opened.
- ◆ If COMPAX performs a travel motion, the drive is then decelerated using the programmed ramp time (for E50, E51 and E55 using ramp time P10) and, if specified in the error table, the unit is switched off after this time.
- ◆ Errors ³ E57 are also reported with the binary output O2="0". These errors cannot be acknowledged during a program procedure and when STOP is present.

9.4.1 General error messages

➡ If the measures specified here do not successfully rectify the problem, there is presumably an electrical defect. Please send the unit and an **error description** to HAUSER.

No.	Cause	Action	Acknowledge with	Drive switched off
E00	Interruption of a positioning command using STOP / BREAK; is only reported via RS232.		Not necessary	no
E01	Not configured.	Perform configuration.	Quit	yes
E05	Machine zero initiator not found. Error is only generated when using reversing initiators.	Check initiator.	Quit	no
E07	Calculation error	Check programmed arithmetic. (for a more accurate cause in the optimization display P233/243=39; refer to page 101)	Quit	no
E08	Synchronous STOP in place	Check P219	Quit	no
E09	Drive not running.	Remove mechanical blockade (tools, foreign bodies).	Quit	no
E10	Lag error too large. or speed difference too great	Check mechanics for smooth operation, reduce load or feed force or increase P13. This error message can be turned off by setting P13="0".	Quit	see below
E11	Programmed position not reached.	Remove mech. obstacles or increase P14.	Quit	no
E15	Error in 2nd position measuring system.	Check configuration and wiring.	Quit	yes
E16	The data record number selected does not exist.	Select data record number between 1...250.	Quit	no
E17	The data record number selected is too large. ⁵⁷	Select data record number between 1...250.	Quit	no
E18	The maximum data record 250 is already assigned.	Free up data record 250.	Quit	no
E19	No space available in natural language memory.	Delete data records or entire natural language memory.	Quit	no

⁵⁷ for COMPAX 70: curve number not available.

General error messages

No.	Cause	Action	Acknowledge with	Drive switched off
E20	Target position beyond positive end limit.	Correct target position.	Quit	no
E21	Target position beyond negative end limit.	Correct target position.	Quit	no
E22	Machine zero is not approached.	Find machine zero. This must be found after power on.	Quit	no
E23	The present command issued is not permissible.	◆ Positioning command in speed control mode. ◆ Approach MN in speed control mode. ◆ Travel command when drive is switched off. ◆ Hand +/- when an error is present. ◆ More than 8 comparator commands one after another (for preparatory commands, refer to page) in the natural language memory.	Quit	no
E24	The speed selected is not valid.	Enter speed between 0...100%.	Quit	no
E25	The position selected is not valid.	Note end limits and/or note "Software end limit monitoring" chapter in variant documentation.	Quit	no
E26	REPEAT without END or RETURN without GOSUB.	Insert END / RETURN command.	Quit	no
E27	Parameter must not be described.	Check parameter.	Quit	no
E29	Motor values missing.	Send unit to HAUSER.	Quit	yes
E30	Hardware fault.	Remove extreme external sources of fault.	Quit	yes
E31	Error in parameters.	Check parameters.	Quit	no
E32	Error in the parameters.	Check parameters.	Quit	no
E33	Error in program memory.	Check natural language memory.	Quit	no
E34	Error in program memory.	Check natural language memory.	Quit	no
E35	Hardware fault.	Remove extreme external sources of fault.	Quit	no
E36	Hardware fault.	Faulty or incorrect unit hardware.	Power on	yes
E37	Auxiliary voltage +15 V missing.	Switch on again.	Power on	yes
E38	Voltage in Intermediate circuit too high; e.g. if braking output is too high. Limits: COMPAX 25XXS: >400V otherwise: >800V	Increase braking and idle times / check mains power. COMPAX 25XXS: external ballast resistance not in place. COMPAX 45XXS / 85XXS: bridges X2/5 - X2/6 not in place.	Quit	yes
E39	Temperature too high (>85°), cycle too hard.	Increase acceleration times.	Quit	yes
E40	Input "Enable final stage" (X3/1-X3/2) not assigned  Only for COMPAX 45XXS and COMPAX 85XXS.		Quit	yes
E41	Final stage reports error. For COMPAX 35XXM: short circuit of ballast resistance or undervoltage 24V	Check motor and cable for ground connection, short circuit connection and function; remove extreme external sources of fault.	Quit	yes
E42	Resolver / sensor error.	Check resolver cable and connector for correct connections and faults.	Quit	yes
E43	Output overloaded.	I/O check cable, connector and external circuit. Note the load limits (refer to start-up manual).	Power on	yes
E44	Pos. auxiliary voltage outside tolerances.	Switch unit on again.	Power on	yes
E45	Neg. auxiliary voltage outside tolerances.	Switch unit on again.	Power on	yes
E46	Supply voltage +24V is too great.	Check +24V DC power unit.	Power on	yes
E47	Supply voltage +24V is too low.	Check +24V DC power unit.	Power on	yes

No.	Cause	Action	Acknowledge with	Drive switched off
E48	Motor thermal switch reports error.	Check resolver cable, motor type and motor / remove external sources of heat.	Power on	yes
E49	Motor or drive reports blockage. Drive remaining in the current limit for longer than P108 (P16)	Free mechanics. This error message can be turned off by setting P13="0". Check motor cable.	Quit	yes
	COMPAX-S: speed controller oscillates	Optimize controller (reduce P23 stiffness).		
E50	Limit switch 1 activated.	Operate by hand from limit switch.	Quit	no
E51	Limit switch 2 activated.	Operate by hand from limit switch.	Quit	no
E52	Error in emergency stop circuit.	Check emergency stop switch, contacts relay.	Quit	yes
E53	Motor overloaded.	Check dimensions.	Quit	yes
E54	Speed higher than the maximum motor speed or higher than P15*1,21	Reduce nominal speed or, if speed is too high, use harmonics; optimize controller.	Quit	yes
E55	External emergency stop. Intermediate circuit not approved. Excess temperature.	Check system, then switch unit on again. Voltage must be at least 2s >320V. External load too great.	Quit	yes
E56	Emergency stop available directly on COMPAX-M via X9/6 (switched on using P219=7)	Check system, then switch on again.	Quit	yes
E57	Voltage in intermediate circuit too low (<70V).	Check mains supply connection. You can switch off E57 using P218 ="1".	Quit	yes
E58	Temperature is too high. (>75°)	Increase acceleration times.	Quit	no
E65	Encoder error	Check encoder cable. Axis is brought to a stop through speed control. (switch off using P218)	Quit	no
Negative command acknowledgement (only for warnings)				
E72	Block check character error or gen. fault.	Resend the characters	*	no
E90	Syntax error; command not valid	Check command structure.	*	no
E91	Command cannot be performed in this COMPAX operating mode	Check COMPAX status	*	no
E92	Function running, command cannot be performed		*	no
E93	Natural language memory active, command cannot be performed		*	no
E94	Password not in place		*	no

* no Quit is required.

Response to lag error (error E10)

Position controller

COMPAX is switched over from position control mode to speed control mode and speed 0 is specified. The drive remains powered.

The next move command after the error acknowledgement brings the system back to position control.

Response to E15

COMPAX is switched over from position control mode to speed control mode and speed 0 is specified. The drive remains powered.

Speed controller

In speed control mode, control is referenced to speed 0.

9.4.2 Special bus options error messages

No.	Cause	Remedy / Causes	Acknowledged with	Drive switched off
RS485 interface (option F1/F5)				
E70	Parity error	Resend the characters	*	no
E71	Overflow of COMPAX intermediate memory; more than 40 characters have been transmitted.	Transfer again with fewer characters	*	no
E72	Block check character error	Resend the characters	*	no
E73	Time-out error	Resend the characters	*58	no
E74	Busy error		Power on	no
CAN bus (option F4)				
E70	CAN bus transmission error	Check physical connection	Quit ⁵⁹	no
E75	CAN bus inactive	Check physical connection	Power on	no
CANopen (option F8)				
E73	Node monitoring error The error response is influenced with P191.	No longer connection with master Monitoring time and/or lifetime factor not set correctly	60	no ⁶¹
Profibus (option F3)				
E73	Time-out error	Resend the characters	*	no
Interbus S (option F2)				
E73	Time-out error	Resend the characters	*	no*
HEDA (option A1 / A3)				
E76	Synchronization error during HEDA transmission	Check physical connection or P249.	Quit	no
E77	HEDA transmission error	Check physical connection or P247.	Quit	no
E78	HEDA transmission errors one after another	Check physical connection or P248.	Quit	no
E79	Coupling error	Check nominal value specification via HEDA or P181	Quit	no

58 *error E 73: no Quit required; the error message is deleted when the next transfer occurs without incurring any problems. Behavior independent of P191.

59 Error E70 can be acknowledged if a successful transfer is then made.

60 Start_Remote_Node indication.

COMPAX automatically goes into pre-operational state due to the emergence of a node monitoring error.

61 dependent on P191.

10. Application examples

10.1.1 Overview

External data record selection..... 184

Application:

One of eight various workpieces should be made available at a data collection station. The number of the desired workpiece is set using a BCD selector switch. The transportation process is then triggered by a starting pulse.

Mark-referenced positioning 186

Application:

Pieces with lengths of between 100 mm and 500 mm should be cut from a plate roller. The cut-off positions are specified by marks on the plate. If two marks are separated by more than 500 mm, the plate should be pulled back to the last cut-off position.

Speed step profiling / comparator switching points..... 188

Application:

A bore spindle should be guided to the surface of the workpiece using a rapid feed movement. The bore is then bored to a defined depth using a considerably longer feed. When reversing the bore spindle, the unit should travel at a slow velocity while the drill is still in the bore. The remaining travel to the idle position is performed at a rapid speed.

The bore spindle should be switched on just before the boring process commences and should be switched off immediately after it has been removed from the bore. Movement of the conveyor belt should be blocked for as long as there is a risk of collision between the workpiece and drill.

SPEED SYNC..... 190

Application:

Cartons should be transferred from one conveyor belt (conveyor belt A), a belt operating at a very variable belt speed, to another conveyor belt (conveyor belt C), a belt which has a constant belt speed. This task should be performed using a transfer belt (conveyor belt B) installed between the two other belts. This belt receives cartons from conveyor belt A and, when triggered by a pulse, passes them on to conveyor belt C. In addition to this, when conveyor belt B is assigned, conveyor belt A should be blocked. Conveyor belt B is controlled by COMPAX.

Speed control mode 191

Application:

A centrifuge for manual operation should be operated by an operating mode switch. The centrifugal process should either be run at a permanently set speed or the test tubes should be removed, one after another, through the removal aperture. The shutter on the removal aperture must only be able to open when the centrifuge is at a standstill.

Fast start..... 193

Application:

Material should be fed to an extender stamping machine which operates at a maximum speed of 150 rpm. The material may only be supplied if the stamping tool is open and if the workpiece (already stamped) has been thrown up. The material supply should be released or blocked via a switch.

Implementing a torque converters..... 194

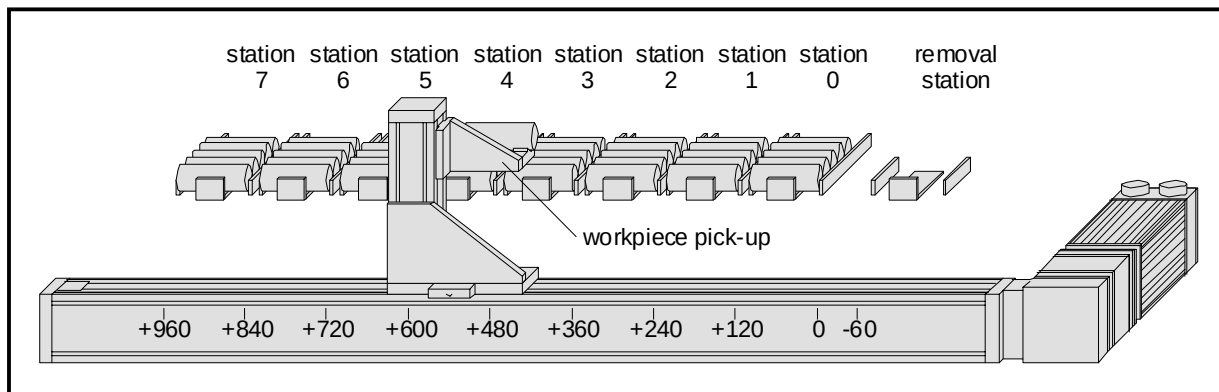
2 options are available for implementing a torque converters.

10.1.2 External data record selection

Application:

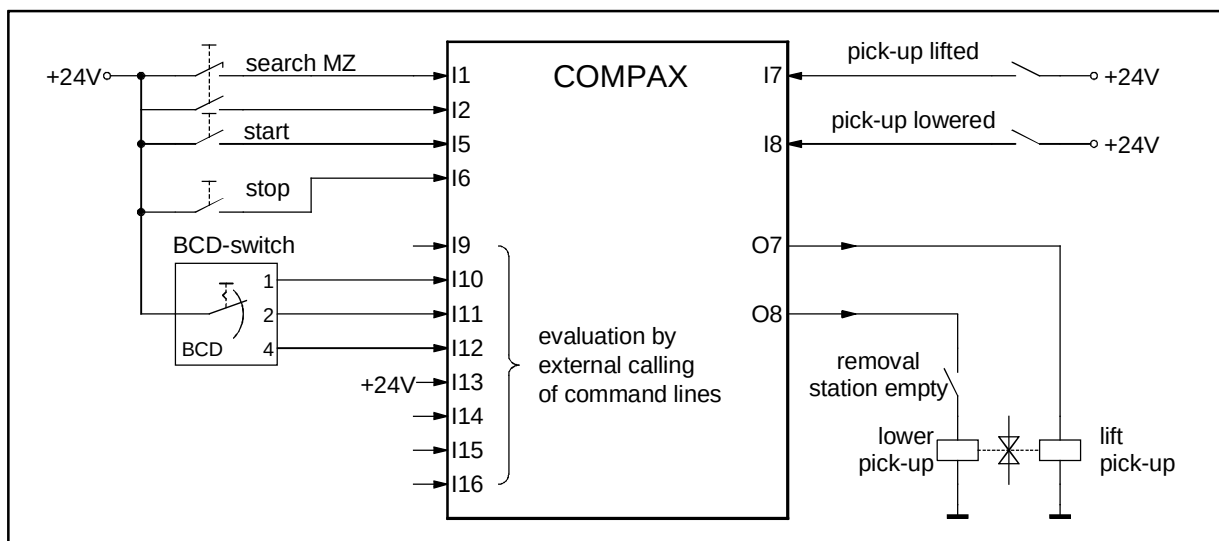
One of eight various workpieces should be made available at a data collection station. The number of the desired workpiece is set using a BCD selector switch. The transportation process is then triggered by a starting pulse.

Assignments:



The horizontal movement is implemented using an NC axis controlled by COMPAX. A pneumatic cylinder, which is controlled by COMPAX using a double solenoid valve, raises and lowers the workpiece pick-up. COMPAX performs all the functions required without superordinate control.

Wiring up the digital inputs and outputs:



Comments:

- ◆ The inputs I9, I14, I15 and I16 have to be placed on GND or left open.
- ◆ The BCD switch has eight settings. The outputs are encoded with binary.
- ◆ The "Data collection station empty" switch is closed when the data collection station is closed. The switch operation prevents the workpiece pick-up being lowered for as long as there is a workpiece in the data collection station.

Function:

The first event after COMPAX has been started is the approaching of the data collection station. If the workpiece pick-up is not lowered, the assumption is made that there is still a workpiece in the workpiece pick-up. This is deposited in the data collection station by lowering the workpiece pick-up. The system is now ready for the first transportation process.

To move one particular workpiece to the data collection station, the number of the station in question is first set on the BCD switch. The process is then triggered by a start pulse. To do this, the BCD switch setting must remain the same until the start of the first axis movement. The lowered workpiece pick-up is positioned under the station which is specified by the BCD switch. When the workpiece pick-up is raised, the front workpiece is taken out of the station. The axis returns to the data collection station. The workpiece pick-up is lowered there. The workpiece is thereby deposited in the data collection station. COMPAX now waits for the next transportation process.

Programming:

Configuration:

P93 =+1 i.e. normal operating mode (absolute and relative positioning)

Names of inputs and outputs:

I7	pick-up raised	0 ⇒ no	1 ⇒ yes
I8	pick-up lowered	0 ⇒ no	1 ⇒ yes
O7	raise pick-up	0 ⇒ off	1 ⇒ on
O8	lower pick-up	0 ⇒ off	1 ⇒ on

List of programs:

```

N001: SPEED 50 .....;sets the speed
N002: ACCEL 500 .....;sets the acceleration and braking ramps
N003: OUTPUT O7=0.....;pick-up raise function = off
N004: OUTPUT O8=0.....;pick-up lowering function = off
N005: POSA -60 .....;moves to data collection station
N006: IF I8=0 GOSUB deposits workpiece (36) ;if pick-up is not lowered: deposits workpiece

    Wait for START: .....;mark
N007: WAIT START .....;waits for the start pulse
N008: GOSUB EXT .....;calls up the corresponding inputs I9-I16 for the sub-program
N009: GOSUB raises workpiece (32) .....;calls "Raise workpiece" sub-program
N010: POSA -60 .....;proceeds to data collection station
N011: GOSUB deposits workpiece (36) .....;calls up "Deposit workpiece" sub-program
N012: GOTO waits for START (7) .....;goes to data record N007

.....;Link table for external data record selection
N016: POSA 120 .....;proceeds to station 0
N017: RETURN .....;returns to main program
N018: POSA 240 .....;proceeds to station 1
N019: RETURN .....;returns to main program
N020: POSA 360 .....;proceeds to station 2
N021: RETURN .....;returns to main program
N022: POSA 480 .....;proceeds to station 3
N023: RETURN .....;returns to main program
N024: POSA 600 .....;proceeds to station 4
N025: RETURN .....;returns to main program
N026: POSA 720 .....;proceeds to station 5
N027: RETURN .....;returns to main program
N028: POSA 840 .....;proceeds to station 6
N029: RETURN .....;returns to main program
N030: POSA 960 .....;proceeds to station 7
N031: RETURN .....;returns to main program

    Raise workpiece : .....;mark
N032: OUTPUT O7=1.....;activates "Raise" solenoid valve
N033: IF I7=0 GOTO 33 .....;waits until workpiece pick-up is raised
N034: OUTPUT O7=0.....;deactivates "Raise" solenoid valve
N035: RETURN .....;returns to main program

    Deposit workpiece : .....;mark
N036: OUTPUT O8=1.....;activates "Lower" solenoid valve
N037: IF I8=0 GOTO 37 .....;waits until the workpiece pick-up is lowered
N038: OUTPUT O8=0.....;deactivates "Lower" solenoid valve
N039: RETURN .....;returns to main program

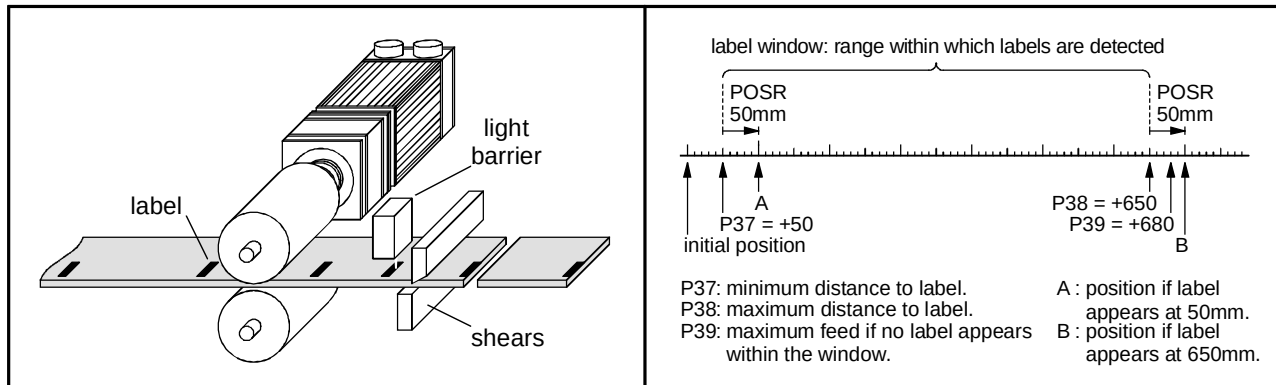
```

10.1.3 Mark-referenced positioning

Application:

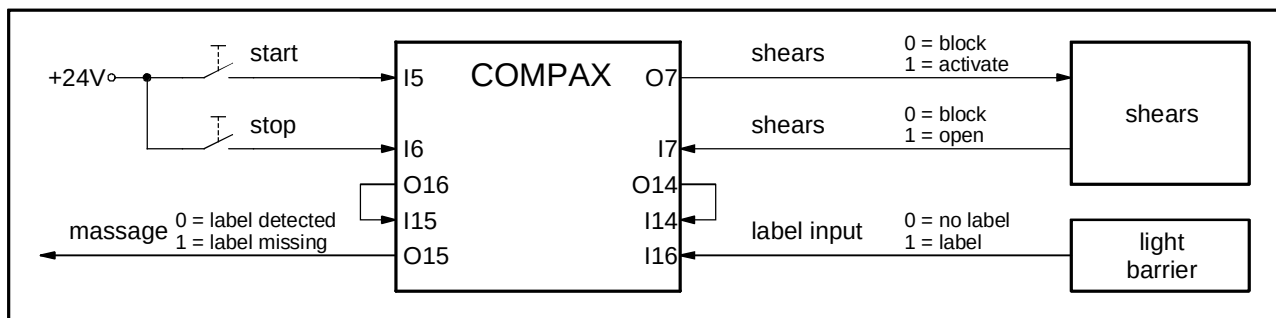
Pieces with lengths of between 100 mm and 500 mm should be cut from a plate roller. The cut-off positions are specified by marks on the plate. If two marks are separated by more than 500 mm, the plate should be pulled back to the last cut-off position.

Assignments:



The plate is fed by a roller feed controlled by COMPAX. A reflex light barrier detects the marks on the plate and reports this to COMPAX. The distance between the light barrier and the shears is 50 mm. The shears are controlled and monitored by COMPAX.

Wiring up the digital inputs and outputs:



Function:

The first event after COMPAX has been started is a rest of the control outputs. Once assurance has been received that the blades of the shears are open, COMPAX is ready for the initial cutting to length. The cutting to length process is triggered by a start pulse. COMPAX firstly activates the mark reference (I14) using O14. After a waiting time of 10 ms (which is used to compensate for any possible COMPAX timing offset), the mark-referenced positioning process is started using the "POSR 50 mm" command. The mark input (I16) is approved after a travel distance of 50 mm (P37). If the light barrier now detects a mark, COMPAX pushes the plate another 50 mm. This distance corresponds to the distance between the light barrier and the shears and is programmed using "POSR 50 mm". If no mark has been detected after a travel distance of 650 mm (P38), COMPAX stops the feed movement after a total of 680 mm (P39). At the end of the positioning process, output O16 indicates whether a mark has been detected within the mark window or not. This output is queried using I15.

If I15 is at 1 (i.e. mark found), COMPAX sets the message output O15 to 0 and activates the shears. Once the blades have opened, COMPAX waits for the next start pulse. If I15 is 0 (i.e. no mark found), COMPAX sets the message output O15 to 1, blocks the mark reference (I14) via O14, pulls the plate back by 680 mm to the last cut-off position and waits for the next start pulse.

Programming:

Configuration:

P93 = +2 i.e. continuous operating mode
P35 = +1 i.e. mark reference switched on
P37 = +50 i.e. minimum travel to mark = 50 mm
P38 = +650 i.e. maximum travel to mark = 650 mm
P39 = +680 i.e. maximum feed length, if no marks appear in the mark window = 680 mm

Names of inputs and outputs:

I7 shears	0 ⇒ closed	1 ⇒ open
I15 mark	0 ⇒ missing	1 ⇒ found
O7 shears	0 ⇒ block	1 ⇒ activate
O14 mark reference	0 ⇒ block	1 ⇒ activate
O15 message	0 ⇒ mark found	1 ⇒ mark missing

List of programs:

N001: SPEED 50.....;sets the speed
N002: ACCEL 250.....;sets the acceleration and braking ramp
N003: OUTPUT O7=0.....;shears = block
N004: OUTPUT O14=0.....;mark reference = block
N005: OUTPUT O15=0.....;message = mark found

Wait for start:.....;mark
N006: IF I7=0 GOTO 6.....;waits until shears are open
N007: WAIT START.....;waits for start pulse
N008: OUTPUT O14=1.....;activates mark reference
N009: WAIT 10.....;waits until mark reference is activated
N010: POSR 50.....;mark-referenced positioning
N011: WAIT 10.....;waits until mark is missing or set
N012: IF I15=0 GOTO reverses (18).....;if mark is missing, reverses plate
N013: OUTPUT O15=0.....;sets "Mark found" message
N014: OUTPUT O7=1.....;activates shears
N015: IF I7=1 GOTO 15.....;waits until shears are closed
N016: OUTPUT O7=0.....;blocks shears
N017: GOTO waits for start (6).....;goes to data record N006

Reverse:.....;mark
N018: OUTPUT O15=1.....;sets "Mark missing" message
N019: OUTPUT O14=0.....;blocks mark reference
N020: WAIT 10.....;waits until mark reference is blocked
N021: POSR -680.....;returns to start point
N022: GOTO waits for start (6).....;goes to data record N006

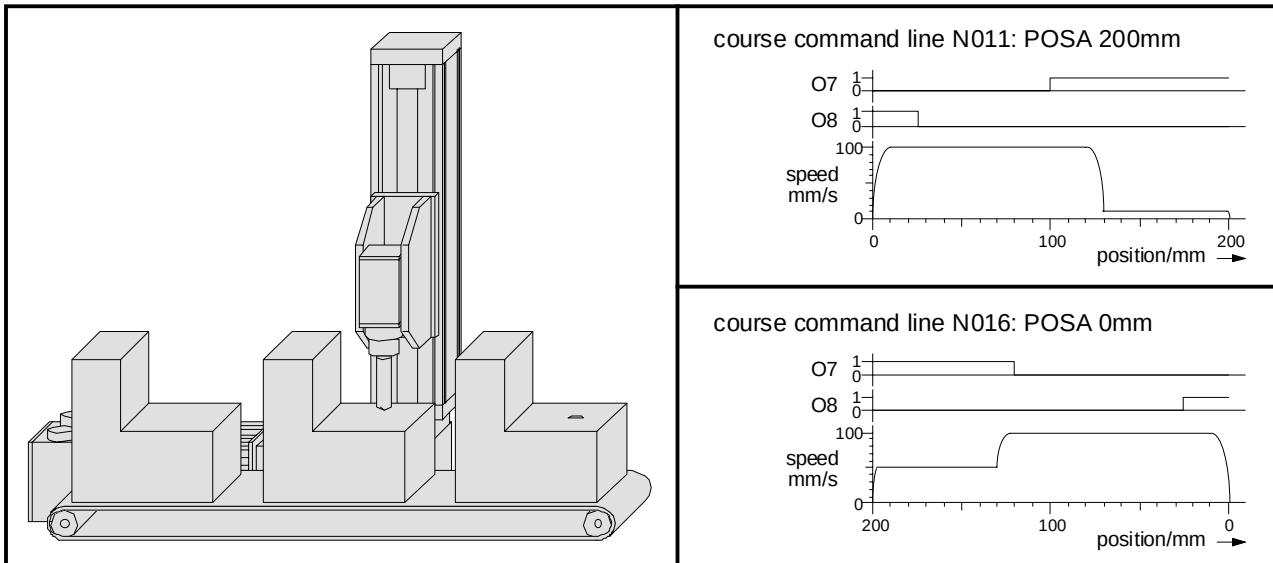
10.1.4 Speed step profiling / comparator switching points

Application:

A bore spindle should be guided to the surface of the workpiece using a rapid feed movement. The bore is then bored to a defined depth using a considerably longer feed. When reversing the bore spindle, the unit should travel at a slow velocity while the drill is still in the bore. The remaining travel to the idle position is performed at a rapid speed.

The bore spindle should be switched on just before the boring process commences and should be switched off immediately after it has been removed from the bore. Movement of the conveyor belt should be blocked for as long as there is a risk of collision between the workpiece and drill.

Assignments:



Function:

The feed movement is implemented using speed step profiling. The initial speed is first set to 100 mm/s using the "SPEED 100%" command (N007). This speed can be used until the start of the boring process. After a travel distance of 120 mm, the boring begins and the speed should then be 10 mm/s. The "POSR 120 mm SPEED 10%" command (N011) ensures that the speed is reduced from 100 mm/s to 10 mm/s for the following positioning after a distance of 120 mm. The position as of which the speed is then 10 mm/s depends on the set braking ramp (N001) and the output speed (N007). This means that braking is initiated from an appropriate stopping distance from the position where the bore starts.

When returning, the initial speed is set to 50 mm/s (N012) and, as of a travel distance of 70 mm, is accelerated to 100 mm/s (N013).

The bore spindle is switched on and off with the aid of the comparator switching points. During the feed movement, the spindle is switched on after a travel distance of 100 mm (N009). By the time the boring process begins after 130 mm, the spindle must have reached its operating speed. The spindle is switched off again when returning once the drill has left the bore (N014).

The conveyor belt is blocked for as long as the axis is located at a position of between 25 mm and 200 mm (N008 and N015).

Programming:

Configuration:

P93 = +1 i.e. normal operating mode (absolute and relative positioning)

P94 = +1 i.e. linear ramp shape

SPEED 100% corresponds to 100 mm/s

Names of the inputs and outputs:

O7 bore spindle	0 ⇔ off	1 ⇔ on
O8 conveyor belt	0 ⇔ block	1 ⇔ release

List of programs:

N001: ACCEL 200 ;sets the acceleration and braking ramps

N002: SPEED 100 ;sets the speed

N003: POSA 0 ;approaches idle position

N004: OUTPUT O7=0 ;bore spindle = off

N005: OUTPUT O8=1 ;conveyor belt = release

Wait for start: ;mark

N006: WAIT START ;waits for start pulse

N007: SPEED 100 ;sets starts speed to 100%

N008: POSR 25 OUTPUT O8=0 ;sets the comparator point of the "Block conveyor belt"

N009: POSR 100 OUTPUT O7=1 ;sets the comparator point of the "Switch on bore spindle"

N010: POSR 120 SPEED 10 ;sets the speed steps

N011: POSA 200 ;performs the positioning command with the set procedure

N012: SPEED 50 ;sets starts speed to 50%

N013: POSR 70 SPEED 100 ;sets speed step

N014: POSR 80 OUTPUT O7=0 ;sets the comparator point of the "Switch off bore spindle"

N015: POSR 175 OUTPUT O8=1 ;sets the comparator point of the "Release conveyor belt"

N016: POSA 0 ;performs the positioning command with the set procedure

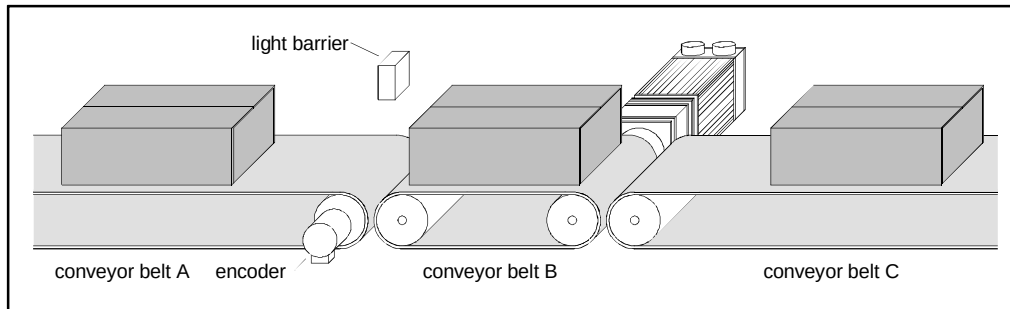
N017: GOTO waits for start (6) ;goes to data record N006

10.1.5 SPEED SYNC

Application:

Cartons should be transferred from one conveyor belt (conveyor belt A), a belt operating at a very variable belt speed, to another conveyor belt (conveyor belt C), a belt which has a constant belt speed. This task should be performed using a transfer belt (conveyor belt B) installed between the two other belts. This belt receives cartons from conveyor belt A and, when triggered by a pulse, passes them on to conveyor belt B. In addition to this, when conveyor belt B is assigned, conveyor belt A should be blocked. Conveyor belt B is activated using COMPAX.

Assignments:



Function:

The first event after COMPAX has been started is the release of conveyor belt A. The system then waits until the reflex light barrier (on I7) detects a carton (N003). Should a carton be received, the speed of conveyor belt B is set to that of conveyor belt A (N004). This speed is recorded using an encoder on conveyor belt A transmitting via the COMPAX encoder interface (channel 1). The positioning command (N005) now starts a feed movement using the distance which is required to transfer the whole carton onto conveyor belt B. Since the feed time is always the same as the speed of conveyor belt A, no errors occur due to slip between the carton and one of the conveyor belts. Once the whole carton has been received, the system waits until I8 reports that the carton has been passed to conveyor belt C (N008). If, during this waiting time, another carton arrives via conveyor belt A, this is blocked via O7. When the carton is passed on and conveyor belt A is blocked, the speed of conveyor belt B is set to that of conveyor belt C (N010). The carton is transferred to conveyor belt C at this constant speed using N011. Conveyor belt A is then released again (N002).

Programming:

Configuration:

Encoder input E2 option

P93 = +2 i.e. continuous operating mode

P98 = 314 i.e. travel per axis per encoder revolution = 314 mm

P143 = 4096 i.e. encoder pulse number = 4096

Names of the inputs and outputs:

I7	receive carton	0 ⇔ no	1 ⇔ yes
I8	deposit carton	0 ⇔ no	1 ⇔ yes
O7	conveyor belt A	0 ⇔ block	1 ⇔ release

List of programs:

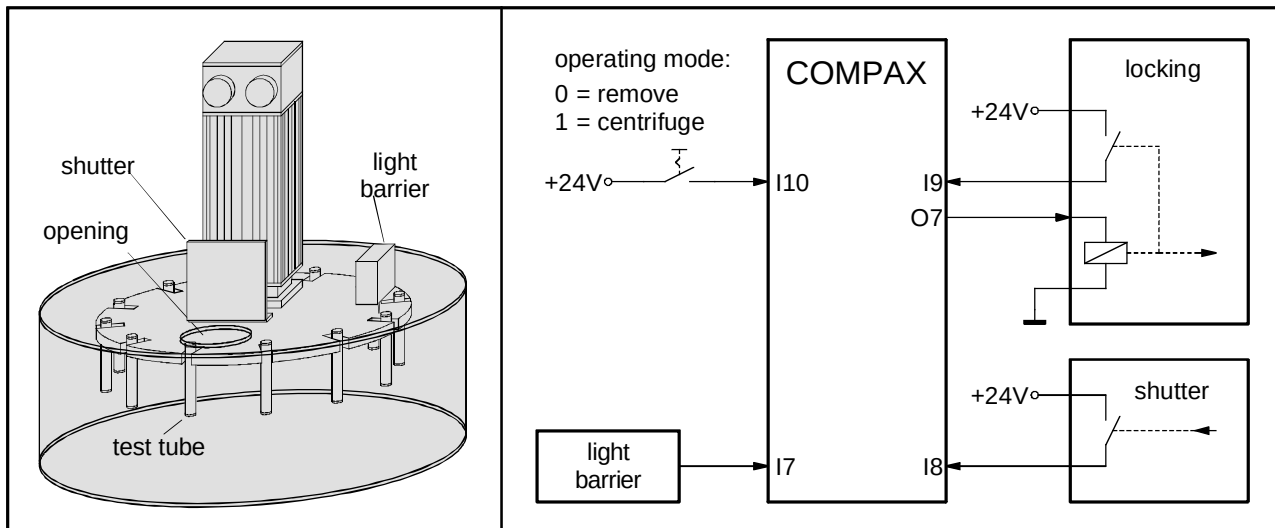
N001: ACCEL 200;sets the acceleration and braking ramps
 Transfer carton:;mark
 N002: OUTPUT O7=1.....;releases conveyor belt A
 N003: IF I7=0 GOTO 3;waits until carton is to be received
 N004: SPEED SYNC;sets the speed to that on conveyor belt A
 N005: POSR 360;transfers the carton
 N006: IF I7=0 GOTO 8;queries whether carton is to be received
 N007: OUTPUT O7=0.....;blocks conveyor belt A
 N008: IF I8=0 GOTO 6;waits until carton is to be deposited
 N009: OUTPUT O7=0.....;blocks conveyor belt A
 N010: SPEED 85;sets the speed to that on conveyor belt C
 N011: POSR 350;deposits the carton
 N012: GOTO transfers carton (2);goes to data record N002

10.1.6 Speed control mode

Application:

A centrifuge for manual operation should be operated by an operating mode switch. The centrifugal process should either be run at a permanently set speed or the test tubes should be removed, one after another, through the removal aperture. The shutter on the removal aperture must only be able to open when the centrifuge is at a standstill.

Design and wiring up of the digital inputs and outputs:



Function:

The first event after COMPAX has been started is the setting of the accelerating and braking time 10s (N001). A check is then run to find out whether the shutter is closed (N002). If it is not closed, the interlock is opened (N003) and the system waits until the shutter is closed (N004). If the shutter is closed, the interlock is also closed (N005). The interlock is checked for safety reasons (N006). The operating mode switch is then queried (N007).

If this is set to "Removal", the speed is set to 0.1 % using N008. The system waits until the light barrier is activated by a test tube (N010). When this occurs, the speed is set to 0 (N011) and the interlock is opened (N012). The shutter can now be opened to insert or remove a test tube. COMPAX monitors the opening and closing of the shutter (N013 / N014) to lock this again after the closing (N015 / N016) and to return to the operating mode query. If "Removal" is still set, the centrifuge is turned further to the next test tube. (N009 ensures that once the speed has accelerated to 0.1% (N008), the system waits until the previous test tube no longer activates the photoelectric barrier.)

If the operating mode switch is set in the "Centrifuge" position, the centrifuge is accelerated to 100% within 10s (N018). This speed is retained until the operating mode switch is set to "Removal" (N019 / N020). Then, the centrifuge is decelerated to 0.1% (N008) and stops at the next test tube. The test tubes can then be removed one after another.

Speed control mode

Programming:

Configuration:

P93 = +4 i.e. speed control operating mode

P94 = +2 i.e. smooth ramp shape

Names of the inputs and outputs:

I7 light barrier	0 ⇒ not activated	1 ⇒ activated
I8 shutter	0 ⇒ open	1 ⇒ closed
I9 interlock	0 ⇒ open	1 ⇒ closed
I10 operating mode	0 ⇒ remove	1 ⇒ centrifuge
O7 interlock	0 ⇒ closed	1 ⇒ open

List of programs:

N001: ACCEL 10 000;sets the accelerating and braking ramps to 10s

N002: IF I8=1 GOTO locks (5);checks whether the shutter is closed

N003: OUTPUT O7=1;opens interlock

N004: IF I8=0 GOTO 4;waits until the shutter is closed

Lock:;mark

N005: OUTPUT O7=0;closes interlock

N006: IF I9=0 GOTO 6;checks whether interlock is closed

Operating mode query:

N007: IF I10=1 GOTO centrifuges (18);queries operating mode switch

Remove:;mark

N008: SPEED 0.1;sets the speed to 0.1%

N009: WAIT 500;waits 500 ms

N010: IF I7=0 GOTO 10;waits until the light barrier is activated

N011: SPEED 0;sets the speed to 0

N012: OUTPUT O7=1;opens interlock

N013: IF I8=1 GOTO 13;waits until shutter is opened

N014: IF I8=0 GOTO 14;waits until shutter is closed again

N015: OUTPUT O7=0;closes interlock

N016: IF I9=0 GOTO 16;checks whether interlock is closed

N017: GOTO operating mode query (7);goes to data record N007

Centrifuge:;mark

N018: SPEED 100;sets speed to 100%

N019: IF I10=0 GOTO removing (8);operating mode query

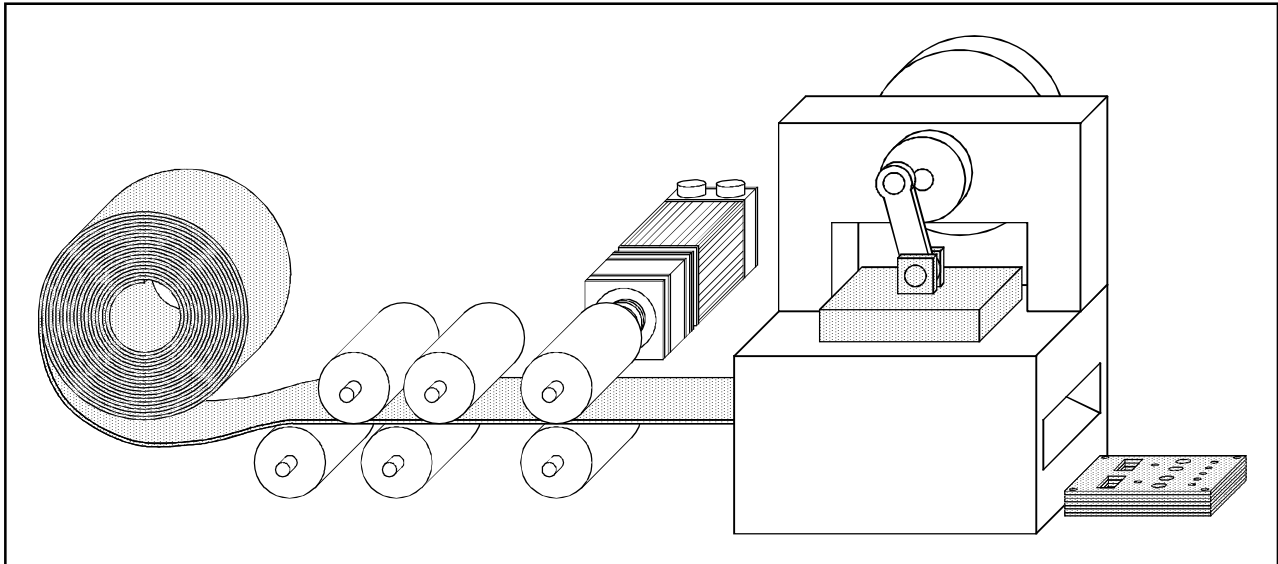
N020: GOTO 19;goes to data record N019

10.1.7 Fast start

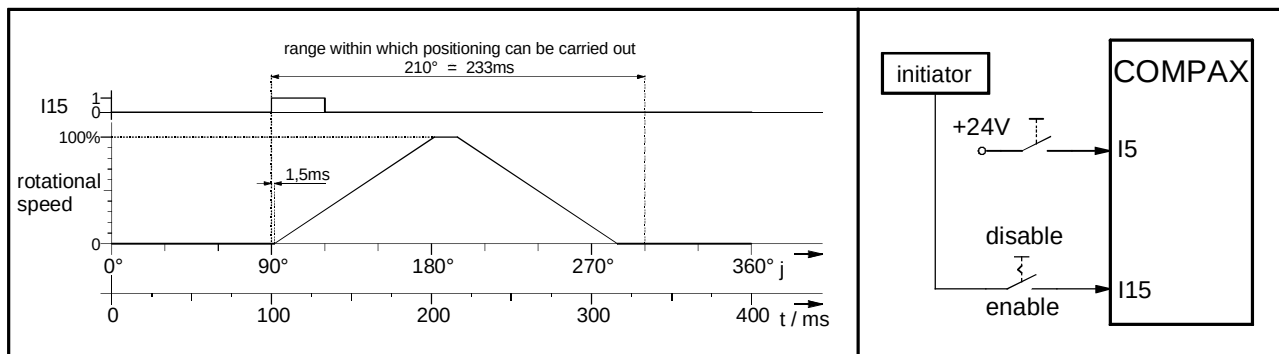
Application:

Material should be fed to an extender stamping machine which operates at a maximum speed of 150 rpm. The material may only be supplied if the stamping tool is open and if the workpiece (already stamped) has been thrown up. The material supply should be released or blocked via a switch.

Assignments:



Function:



When the stamping machine runs at an operating speed of 150 strokes a minute, an operating cycle lasts 400 ms. The operating angle (at which the material can be fed) is 210°. 233 ms therefore remain for the feed movement. To ensure that the necessary drive dynamics are kept within these limits, as much of this time as possible must be used for the actual feed movement. This is why, the fast START is used here as it has a response time of only 1.5 ms. The feed movement is triggered by the signal that the initiator (on the eccentric axis) transfers via the release switch to COMPAX (I15) at an angle of $\varphi = 90^\circ$.

Once the system has been switched on, COMPAX is started via a start pulse on I5. The values for the accelerating and braking time are set in N001 and N002, as are those for the feed speed. The positioning command in N003 is only performed, if a rising flank (from 0 to 1) is detected on I15 (fast START). The time between the rising flank and the start of the feed movement is 1.5 ms. Data record N004 is used to return to N003 which ensures that the next positioning command is prepared. This is then performed after a rising flank on I15.

Programming:

Configuration:

P93 = +2 i.e. continuous operating mode

P94 = +1 i.e. linear ramp shape

P18 = +2 i.e. fast START activated

Names of the inputs and outputs:

I15 fast START a flank from 0 to 1 triggers the fast START

List of programs:

N001: ACCEL 100;sets the accelerating and braking ramps

N002: SPEED 100;sets the speed

Feed:;mark

N003: POSR 225;feed movement (triggered by fast START)

N004: GOTO feed (3);goes to data record N003

10.1.8 Implementing a torque converters

2 options are available:

Using speed control mode

You can attain a defined constant torque in speed control mode using the following setting.

- ◆ Set a high speed which cannot be reached.
- ◆ Define the desired torque using P16 in % of the nominal torque (max. 100%).
- ◆ Switch off errors E10 and E49 using P13=0.

COMPAX tries to reach the specified speed and increases the torque to the maximum permitted torque P16. This value is maintained regardless of the load.

In position controller mode

- ◆ Specify a position which cannot be approached (which is beyond the load position).
 - ◆ Define the desired torque using P16 in % of the nominal torque (max. 100%).
 - ◆ Switch off errors E10 and E49 using P13=0.
 - ◆ You can now use SPEED to also define the speed at which you can run up to the load (block position).
- COMPAX tries to reach the specified position and increases the torque in the load position to the maximum permitted torque P16. This value is maintained regardless of the load.

Changing error response:

E49 can also be switched off individually:

E49 occurs when the current (and/or the torque) remains in the limitation for longer than P108.

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